Our 15th Year

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NOV/DEC 81
VOL. 11, NO. 6

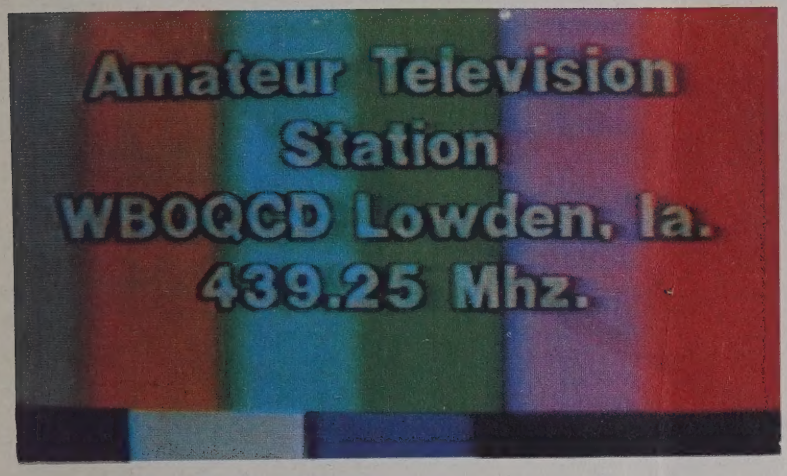
AMATEUR TELEVISION MAGAZINE

"FOR THE SPECIALIZED COMMUNICATION RADIO AMETEUR"

Slow Scan TV

1957 - 1981

K6 AEP "SSTV'ER OF THE YEAR"



FSTV COLOR TEST PATTERN

1981 BIG YEAR FOR COLOR SSTV!

COLOR SSTV FROM NEW GERMAN SC422A

- INDIANA ATV IS ALIVE AND WELL
- 13 FT' HOMEBREW EARTH STATION DISH
- ANT. MOUNTED ATV DOWNCONVERTER
- NEW A5 OPERATING AWARDS
- W6VIO AND VOYAGER 2
- G3OQD VIDEO LIGHT PEN FOR ROBOT 400'S
- MORE SSTV MODIFICATIONS
- NEW 3-MEMORY SSTV COLOR SYSTEMS
- K6AEP MICROS AND SSTV/RTTY
- RTTY THEORY – CHAPTER 2

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Amateur Television Magazine
INTERNATIONAL

Publisher's Foreword

MIKE STONE WBØQCD

Comments have been overwhelming in favor of the "new format" with some stating that they would like to see A5 Magazine expand even further in other areas of specialized communications. As stated on my opening issue, AMATEUR TELEVISION A5 will remain as the "heart" of this publication. SSTV, NBTV, and MSTV comes under the ATV family and will be covered in detail on all issues. Expanded coverage into RTTY, 432 EME/SSB, MICROWAVE, SATELLITES and COMPUTERS are an "added" attraction with "extra" pages as time and finances allow. I think you can see, with my first two editions that ATV hasn't been sacrificed at all. Keep those cards and letters coming! Some of your comments have been included under our "Letters to the Editor" column. This issue, as the frontcover details, is devoted largely to SSTV. Each Nov/Dec issue has been SSTV SPECIALS with last year's front cover photo of Dave 5NØDOG. Printing COLOR is very expensive! My determination to give you the subscriber a quality publication & accurate account of what is going on with the A5 mode led to my committment to expanded pages and as money allows-COLOR photos. I will continue to re-invest monies received back into the magazine to try to improve with each issue of publishment. The "postman" however is not cooperating very much. I have been monitoring issues mailed and found that with last month's issue mail date of September 4th at Kansas by the end of the month some subscribers in California and other states had not yet received their issues. The only way to help this unacceptable delivery schedule is to outwit them and insert a week ahead of time. Notifications went out to all column editor's and advertisers to up deadlines by two weeks so that I may get your issues in the mail a week sooner. Please let me know of any really late arrivals. As we go to press with this issue, the US Postal Service announced another rate increase. I had been giving serious consideration to going with 10 issues per year starting with the Jan/Feb issue, but with the unforseen US Postal Service's constant raising of postage increases, perhaps it would not be a good idea at this time. I have decided to concentrate on the usual six issues per year with enlargement in the number of pages per issue. Past issues averaged 25-30 pages. My issues should never fall under 48 with more to come for 1982! Support A5 Advertisers even if it's an inquiry product card as they are helping to finance the extra weight! A5 Magazine subscribes to QST, 73, CQ, HAM RADIO, CQ, WORLD RADIO, CQ-TV, VHF COMMUNICATIONS, VIDEOPLAY, FOX TANGO, AMRAD, AMSAT, YELLOW SHEETS, as well as on the newsletter mailing list for SWOT, SMIRK, K2UYH EME NEWS, W6VIO, SCAL ATV, CARRS, and others. "Reprints" will appear from time to time from these publications (with permission of course) on articles of interest to the A5 reader. Let A5 be the "clearing house" for the articles and information you are interested in and we will print them for you. Some members received the new Sep/Oct issue mailing even though their subscription was expired. This was done to let all know of what to expect in future issues with the change of ownership. It cost the Magazine some extra money, but I hope we "renewed" some of you who were getting a bit disappointed. We have increased about 300 subscribers from takeover which is not too bad. Please help us by passing the word about A5 Magazine. You wouldn't believe how many people into the A5 mode will say "Whats A5 Magazine" (after 15 years!)? A5 Magazine has not raised its prices of subscriptions thru the last two postal raises. Effective with the Jan/Feb issue, A5 Magazine will raise subscription costs to $10.00 per year. Careful study was made of actual cost to run this publication. With the rising postal rates (even at 2nd class bulk mailing) along with the expansion in pages and COLOR printing (as well as regular printing increases) to survive and do what we want to do with the periodical we are forced to increase rates. Compared to other Amateur publications, the $10 price is a real bargain. We will honor all new and renewel subscriptions up to the Jan/Feb issue at the regular price. Our eagerness and search for new advertisers has helped quite a bit. I will not, however, bow to advertisers with products unrelated to A5 or specialized communications. There is enough of that "junk" in the other magazines. I have literally turned down dozens of advertisers peddling HF equipment and non-specialized mode gear. I think this is what you want to continue to see also. A late note from ATV operator WDØEKP states that he is underway with his construction of a 2200 Ghz.? receiver for TV and antenna system to watch the flyby of the upcoming Space-Shuttle launch. Any brave souls fooling around with things like that? Full coverage of W6VIO and Voyager 2's encounter with Saturn in August is included in this issue. W6ORG linked it all together for the public to view. Our "congratulations" to the VIO group on behalf of all ATV/SSTV Amateurs' worldwide. We welcome some new advertisers; HOOSIER ELECTRONICS, WORLD NEWS, SILVERNAIL ELECTRONICS, CQ-TV, SPECTRUM INTERNATIONAL, SELECTO INCORPORATED, DATA SERVICE, DIGITAL ELECTRONIC SYSTEMS and HAL COMMUNICATIONS. We appreciate your support in advertising in A5 Magazine and know that our "readers" will respond favorably. Our congratulations to Clay Abrams, K6AEP as 1981 "SSTVER OF THE YEAR"! His devotion to blending the world of micro's and SSTV/RTTY are amazing! (See articles by Clay). This issue will be a sought after issue for SSTV'ers. Extra copies have been printed so pass the word! -WBØQCD

HAPPY HOLIDAYS! From A5 Magazine

Letters to the Editor

FROM OUR "READERS" :

"I am jotting this quick note in response to a comment in A5 Magazine, last issue. I am very much in favor of some Rtty topics. There is not much general knowledge about Rtty and yet there is much interest especially with the advent of the newer solid state gear on the market. In Chicago, there is much Rtty interest. I believe that Rtty topics would be of much interest to all who read A5 Magazine." -Brian Davis, W9HLQ, Tinley Park, Ill.

"I just read the September issue of CQ Magazine and see that there is an SSTV contest coming up on Labor Day weekend. Please send me the details on the WAS contest immediately! I probably can't compete with the Robot 400's and keyboards but it should be alot of fun. There are about three SSTV stations I know in Jacksonville. I am using a Venus SS2 converter with a Venus C Camera and a Sony recorder." -Joseph "Tex" Kern, W4MET, Jacksonville, FL.

"There is now a FSTV Repeater in Montreal; Input 436.00 Output 446.00 Mhz. Audio talkback is on 2 meters. Black and White and experimentation in Color is encouraged. A test pattern is also available. We use horizontal polarization (3 yagis in different directions) and the repeater is on the air from 1 pm. to 1 am. daily. 73's"-Bruce Balla, Box 392, Montreal, Canada

"We now have 10 ATV stations operating in the greater Houston area at 439.25 Mhz. Some of the stations are W5OBS, WD5BWC, W5KXJ and WA5YBC." -Unsigned note

"I have enjoyed the past issues of A5 Magazine and I am sure I will be able to survive with 3 more yrs. -enclosed is money for a 3 year renewel! Keep up the good work! I understand the Collins Amateur Radio Club in Texas is planning a 440.00 Mhz. in 2300.00 Mhz. out ATV Repeater once they find a 2300 transmitter they can afford. Best regards" -Richard Byron, JD., KA5FIV.

"W9WED and KA9BPC both of Du Quoin, Ill. have been on FSTV in Color and sound for about six weeks now and are getting good results across town! Haven't tried ATV-DX yet because we are upgrading our antenna systems." -W9WED Buster Alongs, Du Quoin, Illinois

"Your A5 Magazine readers might be interested to know that after lengthly considerations from the South African Postal Authorities, that they have decided to grant permission to ARS ZS6KM to operate FSTV within the 430-440 Mhz. band. Until now, only the 1215 Mhz. region was available for ATV to South African hams interested in technically interested projects. We hope to have a 70 cm. ATV net going soon as meaningful experimentation becomes possible. Best wishes, 73's and good DX" -Dr. M. Karny, ZS6KM, Queenswood, PTA, South Africa.

"I would like to inform you of a very special event that Amateur Radio will be taking part in in the state of Utah Sept. 28th thru October 25th. The event is a new world land speed record of 650 mph sponsored by Thrust Cars Ltd. from the Isle of Wight in England with the driver Richard Noble. We will be sending SSTV pictures during this period of time on 14.240, 21.340 with SSB on 21.370 and 14.290 Mhz. ATV coverage will be sent along the 11 mile strip with the FSTV video being relayed back to the pit and the public. Special event callsign will be WA7MTF." (Sorry, the information didnt make in time for the Sep/Oct issue-A5) -Richard Briggs, WA7MTF, Sandy, Utah.

"If WA6JCG's report of his Mari-time ATV Mobile transmission of 475 miles prove's out correct, it is believed to be a new world's record for an ATV shot!" -SCAL Newsletter

"Just a note to let you know that ATV is alive and well in West Texas, 3 stations near San Angelo area; Skeds with KA5L in Odessa are made trying for 120 mile DX-ATV! We have seen sync bars and coordinate every night on 3785 Mhz. at 2100 CST if anyone cares to join us. I am using the PC Electronics system and about 50 watts using a tube amplifier." -James Parsons, San Angelo, Texas.

"Videotape exchanges (ATV stuff) G8PTH, Andrew Emmerson, 4 Mount Pleasant, Canterbury, Eng."

"Anyone build the JAØBZC Fast to Slow Converter in March A5 1979? Having trouble with the 7493 ICs' going from 50 hz. to 60 hz. HELP!" -BERT, VE6PW, Calgary, Alberta-Canada.

"Your September/October issue was fantastic! Antenna review, AMSAT, UOSAT, Test Reports, EME Moonbounce, ATV, SSTV, RTTY, etc. I am still re-reading it all! Keep up the good work! Would like to see another ATV Directory. Am on full-color ATV at 439.25 Mhz.--John J. Champa K8OCL"

A5 World News Roundup

UOSAT SATELLITE launch was delayed several times and at press time was rescheduled for Oct. 3rd. The University of Surrey British Satellite will be launched on a NASA Delta 2310 (two stage plus three solid castor II booster) from the Western Test Range at Vandenberg, California, U.S.A. Of particular interest to A5 operators is General Data Beacon at 435.025 Mhz. and the 145.825 Mhz. SSTV output.

WORLD RADIO NEWS August issue reported after months of attempting to remove the interference from the Pave Paws radar at Beale Air Force Base from the 434.0 Mhz. input to the Contra Costa, CA. ATV Repeater, it was announced that the repeater will abandon the 434 input in favor of a split-band system. Don Smith, W6NKF announced the ATV Repeater will be re-worked to add a 1275.75 down converter at the antenna to feed the IF of the repeater. For further information contact Contra Costa ATV Association, 1639 Martindale Dr., Martinez, CA. 94553.

A5 MAGAZINE announces several new advertisers and Column Editors. Hoosier Electronics, HAL Communications, Inc., Digital Electronic Systems and Spectrum International Systems have comitted to the support of A5 MAGAZINE thru regular advertising. All A5 readers are urged to support our advertiser members as they are supporting A5 MAGAZINE and the "specialized communications" modes. Two new regular Column Editors have been announced; K6AEP Clay Abrams-Computers and KØWVN Joe Elliott RTTY. Look for their articles elsewhere and feed them material requested. Welcome newcomers!

G3WW Richard Thurlow was featured in the "Fenland Advertiser Newspaper" on August 26th for his fine work on receiving the Saturn Voyager 2 pictures via SSTV. An Amateur since 1938, Richard boasts 317 DX Countries, and over 100 DX Countries on SSTV with well over 1500 contacts. Articles concerning the Voyager series flybys are requested to be sent to W6VIO Club in Pasedena, California.

N7AOU Bill Munsil founder of the AAA5 ATV Group in Arizona reports all is going well with the new 2300 Mhz. transmitter for their repeater project. The 1253 Mhz. TV receiver has been completed and tested for a full 24-hour period including audio and AGC. When the system is completed, it will be an ATV Repeater with or without subcarrier audio outputting on 434 Mhz. and 2380 Mhz receiving and demodulating in addition 2 Meter ASCII and Baudot RTTY.

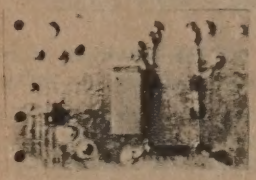
OSCAR-7 IS DECLARED DEAD The 6.6 year old spacecraft has failed to respond to commands since June 24th. AMSAT/OSCAR-7 was launched on 15 November 1974 from Vandenberg AFB at Lompoc, CA. and carried several million contacts for Amateurs including EKG readings from coast to coast.

PEORIA, ILL. "SUPERFEST" was held September 19th and 20th and ATV was there in force! A5 MAGAZINE had two tables with large signs and photos diplicting ATV operation including videotape TV demonstrations showing how to get started on ATV. Don Miller, W9NTP of Waldron, Indiana had the ajoining tables and demonstrated the latest techniques for MSTV and COLOR SSTV. Don conducted two forums which were well attended and received. Tom Barbour, W9LII from Pekin, Ill, showed his Robot 400 & Voyager/Saturn SSTV tapes as he manned the 20 meter Missionary Net display. Over 30 ATV'ers enjoyed the hamfest and evening videomovies under the stars! The Peoria "Superfest" is gaining in momentum and is being recognized as the hamfest outside of Dayton for all ATV'ers to gather and meet. (Miller steals "glazed donuts"!)

WAØINC and WDØEKP now hold the record for simplex ATV DXing in Iowa at 55 miles QRP. ATV is new to Iowa as approximately 20 "brave pioneers" begin the long journey to ATV communications so many others have accomplished. Work is at 439.25 Mhz. with Vertical polarization. Those on-the-air include WDØEKP, WAØINC, WØWOW, WBØZPX, WBØKFB, KAØU, WBØTFV, WBØQCD, WBØARW, WBØMEW, KA9AQR, W9RI, WA9RMR, WB9HTM, WØOJD, WB9MCF, WD9DJJ and WBØETC. Good Luck!

G8PTH, Andy Emmerson of Canterbury, England has VHS format videocassettes available for exchange deplicting Amateur Television activity in England. Andy recently swapped tapes with F1BJB in France and was very pleased with the results. W6ORG Tom in California has sent tapes to Andy showing ATV activity in from the West Coast. WA6SVT, W6ORG and K9KTH have all echanged tapes with WBØQCD with the contents sent over the FSTV airwaves for others to see. Please send your library material that would be available in either a swap or a duplicate tape that would be available for sale to A5 Magazine. The "swapping" of VHS 2-hour format tapes would certainly make for some interesting viewing on these long and cold winter evenings! Lists of tapes available will be published in future issues.

DC-1 UHF CONVERTOR FROM SE



FEATURES:

- VARACTOR FREQUENCY TUNED FOR 18MHZ OF THE 420-450MHZ BAND.
- 2 RF STAGES FOR SENSITIVITY THAT DOES NOT NEED A PREAMP.
- MRF901 RF INPUT STAGE FOR LOW NOISE.
- EASILY ADJUSTED FOR OUTPUT ON TV CHANNEL 2–4.
- ALL STRIPLINE DESIGN WITH DOUBLE SIDED PC BOARD.
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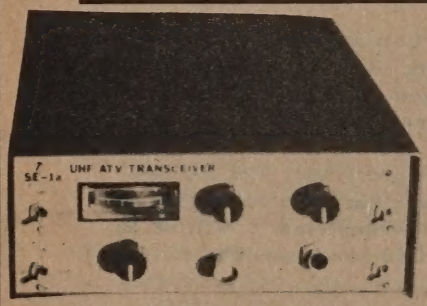
- ONLY 3 TUNING ADJUSTMENTS



SE-1a UHF ATV TRANSCEIVER

NOW AVAILABLE WITH DC–1 RECEIVER CONVERTOR

FEATURES:

- 6 - 8 WATTS AVERAGE VIDEO RF OUTPUT.
- 2 RF STAGE DC-1 TUNER OUTPUTS TO TV CHANNEL 2-4 (specify).
- ILLUMINATED METER SHOWS TRANSMIT AMP CURRENT AND RELATIVE RECEIVE FREQ.
- CRYSTAL CONTROLLED TRANSMIT ON 439.25MHZ (OTHER FREQ. AVAILABLE).
- RECEIVER IS TUNEABLE FOR 18MHZ OF THE 420-450MHZ BAND.
- STRIPLINE LINEAR FINAL WITH RUGGED MRF641 TRANSISTOR.
- AMPLE BANDWIDTH FOR COLOR.
- FRONT PANEL SELECTABLE TRANSMIT AUDIO – 4.5MHZ SUBCARRIER OR FM.
- SOLID STATE TRANSMIT/RECEIVE SWITCHING.
- ALUMINUM ENCLOSURE WITH EPOXY FINISH.
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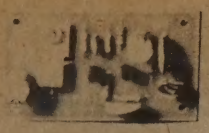
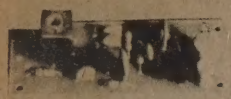
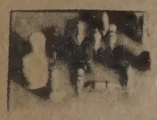
ATV KITS AND MODULES



VM-2 **VIDEO MODULATOR** – Wideband collector video modulator for solid state exciters such as those from GLB and Hamtronics. Input for 4.5MHZ audio sub-carrier. 2½" x 1½"; **$13.95** kit, **$18.95** assembled.

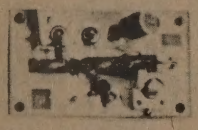


A-2 **4.5MHZ AUDIO SUB-CARRIER** – Accepts audio from VCR or GLB audio processor to provide ATV audio on TV set. Has on-board voltage regulator and shielded inductor. 2 3/4" x 1"; **$18.95** kit, **$24.95** assembled.

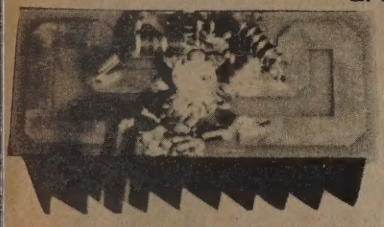


SA-1 **VIDEO SYNC AMP** – Provides separate video sync gain control for VM-2 above or SE-1a transceiver. Useful when driving solid state amps. 1 3/4" x 1 1/4"; **$14.95** assembled, **$11.95** kit.

TVM-1 **TELEVISION MODULATOR** – Adapts standard TV set so it will accept both video and audio. Uses LM1889 IC. 2 5/8" x 2 5/8"; **$22.95** kit, **$32.95** assembled.



P-1 **WIDEBAND LOW NOISE UHF PREAMP** – Uses MRF901 transistor to provide 16db gain and 1.7db noise figure. Covers 420–450MHZ band. Other frequencies received with change in input inductor. 2 1/4" x 1 3/8"; **$17.95** kit, **$26.95** assembled.



LA-1 **UHF AMPLIFIER** – Uses 15 watt MRF641 transistor with 7.8db gain @ 470MHZ. Stripline inductors with on-board pin deode antenna switching for a receiver. Designed for wideband color video with exciters such as the GLB T450L that provides up to 3 watts drive. Drilled and tapped heatsink included (4 1/2" x 1 3/4"). 1 to 3 watts drive typically gives 6 to 18 watts output. 12 – 14vdc operation @ 4 amps max. Double-sided board is 4 ½" x 2". **$69.95** assembled with test data.

PS-1 **POWER SUPPLY** – Converts 13.6vdc to 18-20vdc. Will power UHF varactor tuners and small relays. May be wired to supply negative voltage from +13.6vdc. 1 3/4" x 1"; **$6.95** kit.

GLB T450L TRANSMITTER – 4 1/2" x 2" RF board typically supplies 2–3 watts FM output, 1 – 1½ watts average video RF output. Changes for wideband video modulation provided. Comes with crystal for 439.25MHZ, with other frequencies available upon request. Also includes separate 1" x 4" audio processor board which supplies audio for FM modulation or for the A–2 4.5MHZ audio kit above. 12–14vdc @ 2 amps max. **$54.95** kit, **$74.95** assembled and tuned.

COMMON TO ALL KITS AND MODULES – 12 to 14 vdc operation. Drilled and plated glass circuit boards. Quality components with instructions including schematic and board layout.

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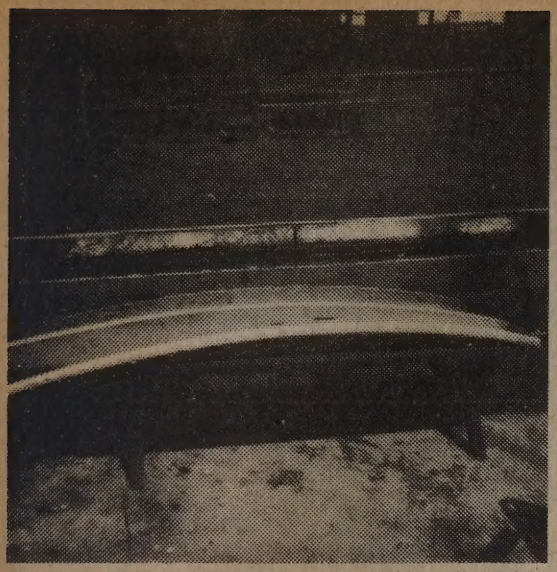
INDIANA ATV IS ALIVE AND WELL!

A5 MAGAZINE VISITS THE SEPTEMBER HOOSIER HAMFEST

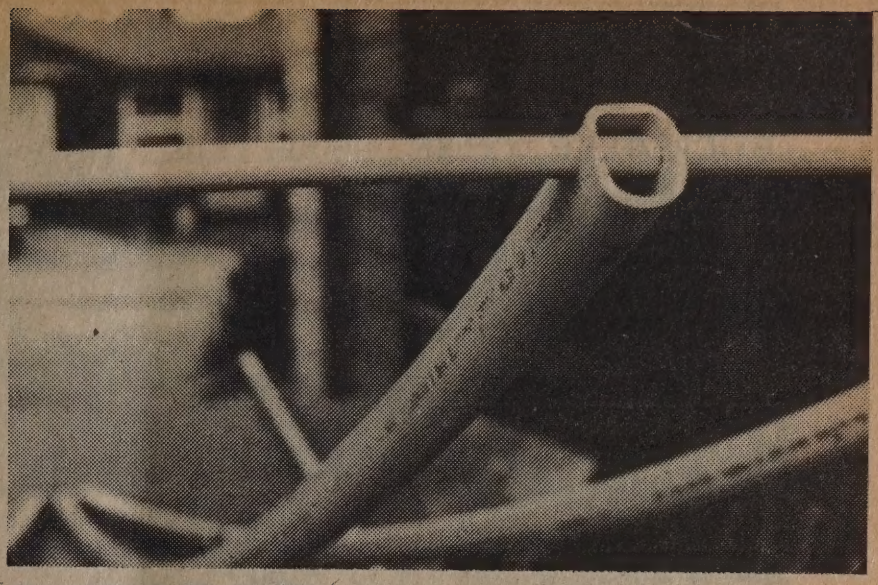
$134.00 13 FOOT HOMEBREW SATELLITE DISH

It was a long drive from Lowden, Iowa to Bloomington, Indiana (8-hours) home of the B.B.S. (I'll let you guess what that stands for) ATV'ers-a questionable bunch of video-idiots running around the states' college town just looking for a camera to "ham it up". Their fearless leader is none other than the infamous Bob Myer(s), K9KTH-know all, do all, soothsayer and chief cook and bottle washer who likes to stay up late and get up early. If you ever travel thru that part of the country (lock the doors), the first strange things that you hear on two meters is the rapid fire comments that appear haphazzardly on the local 147.78/.47.18 Mhz. FM Repeater at all hours of the day and night. Sometimes unidentified, these voices seem to have something to do with the ATV pictures broadcast at 425.25 Mhz. They do have FM audio subcarrier-but seem to delight in watching the present broadcaster go bananas as they torture him or her with background adjitation. Of course, the broadcasters never seem to turn down the volume on the aggravating two-meter rig for fear they might miss something said. So it is an exchange of chatter the neighbors near UHF harmonics must wonder what kind of lunies actually do live in the neighborhood. My visit to K9KTH Bob Myer(s) QTH was an unusual venture. The trip in and out of narrow alleys makes one wonder if he isn't trying to avoid the revenue man or something. As he talked me in I got the feeling that he was just test marketing my defrail ole' 78 Ford LTD to see if it could take the punishment. We arrived in the backyard only to be greeted by a 90 foot tower with several antennas for ATV and HF low-band operations as well as what Bob calls his "birdcatcher" - a 13' Satellite Earth Receiving Dish antenna system. I followed the cable runs into the house to meet his lovely wife who somehow puts up with all this malarky including Bob. (She calls him "lovecakes" when nobody is listening). His shack is like "Sanford and Sons'" back room- a maze of wires, jumpers, radios, scanners, cameras, TV's and books-in otherwords a typical "hamshack". I was quick to realize that you have to talk about #1 Color Camera or #2 TV Monitor is your verbal exchanges as he has more than one of everything. I saw at least 3 Video recording systems, two color cameras, a couple black and whites, four or five TV sets & enough videotape to make me think he orders them by the "gross". (He told me that he makes $5 markup on all tapes that he sells to his friends). (That ought to stir up the airwaves in Bloomington tonight). It was first apparent that with all this fantastic gear sitting around-there was Bob watching the ATV repeaters' output signal on a crappy ole B/W TV that had vertical picture height problems. When I asked why he didn't hook up to the nice Color 19 inch model above it-he commented that that TV was for his Satellite reception and that came first. My son, Jeff, who accompanied me on this trip, was already trying to fiqure out how the remote control vehicles worked with low batteries. Somehow, thru it all- I had a very nice time and knew that it would take a day on Monday to recover from this experience. We attended the Hoosier ATV Hamfest on Sunday, Sept. 5th, saw a large crowd and flea market area, live ATV demonstrations by K9BCP and WA9YJZ. We sold quite a few subscriptions to A5 and met many of the Indiana ATV "buffs" including some from the Indianapolis area. Active ATV'ers on the K9KTH/RPT in Bloomington are: K9KTH, WB9KBJ, WA9YJZ, K9BCP, K9HHY, WB9GOP, WD9GLJ, KA9BST, WA8FGK, WA8WDQ, WD9AQD, WD9CXK, WB9AKG, WB9NZK, W9JIY, W9JIM, WB9GPR, KB9GJ (100 mi.), and W9OJ. We may have missed a few others, but it is apparent that ATV is alive and well in Bloomington, Indiana.

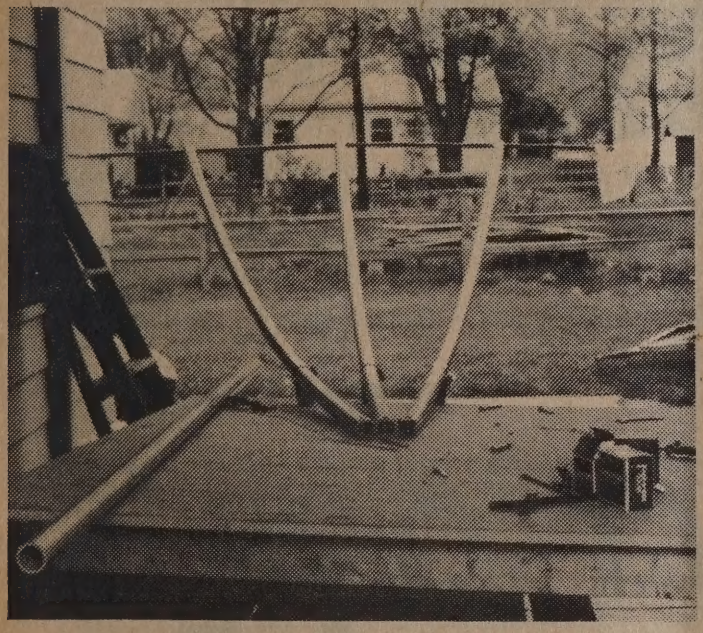
The BBS ATV System is an APTRON model by WA9YJZ. Ron gave me a tour of the repeater site and a videotape of the system. Ron picked me up on Sunday morning and we toured the APTRON facilities in Bloomington. APTRON has quite an impressive setup for parts warehousing, production, labratories & offices. Some of the projects on the "bench" were an ATV system in the 200 Mhz. region (commercial) being designed and built for some Canadians, and a line of APTRON ATV Repeaters. Carefully looking over some of the boards, it was evident that "QUALITY" was the name of the products turned out by them into the marketplace. "We stress workmanship and not quantity here at APTRON and are proud of our work in the TV field" said Ron WA9YJZ as we looked at some of the TV Demodulator boards. (Articles to follow of APTRON gear for Amateur Television). Looking forward to attending the ATV Hamfest next year, we left heading back to Iowa remembering all the gear and those commonplace dual 88 ele. J Beams at many of the QTH's. We drove right by Henry Ruh's place (KB9FO) and saw his YL out mowing the grass and stopped and said hello. Henry's antenna farm for ATV consists of 4-stacked J-Beams & a maze of HF antennas on a 100 foot tower! They certainly take their ATV serious in Indiana. We made it back home in one piece, slept till noon the next day and will carry fond memories of a "wild weekend" trip to Bloomington, Indiana. This month's salute to K9KTH/ATV REPEATER, Bloomington, INDIANA!



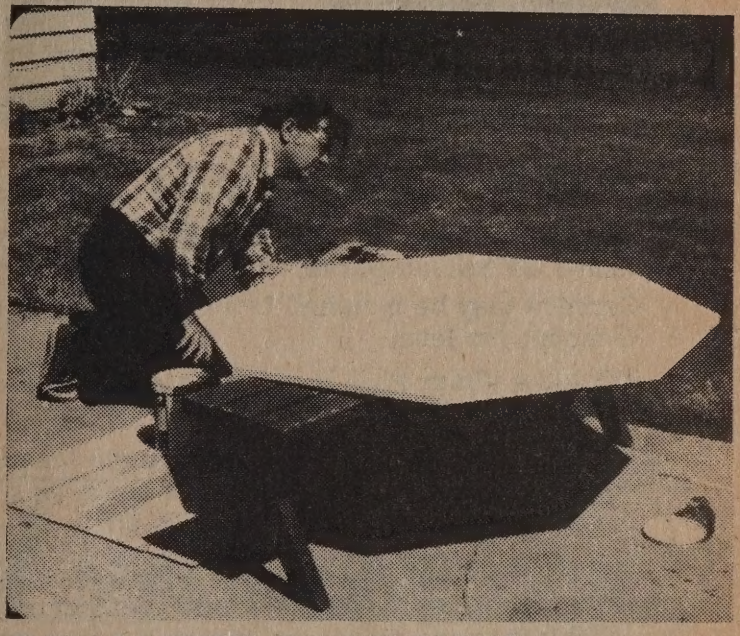
Homebrew OVENS for Plastic Pipe



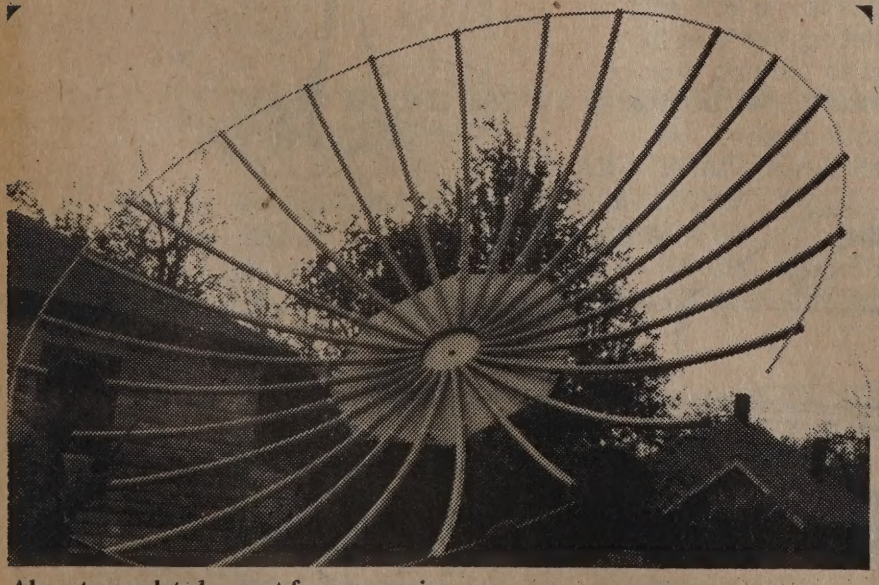
Formed Plastic Element Ribs



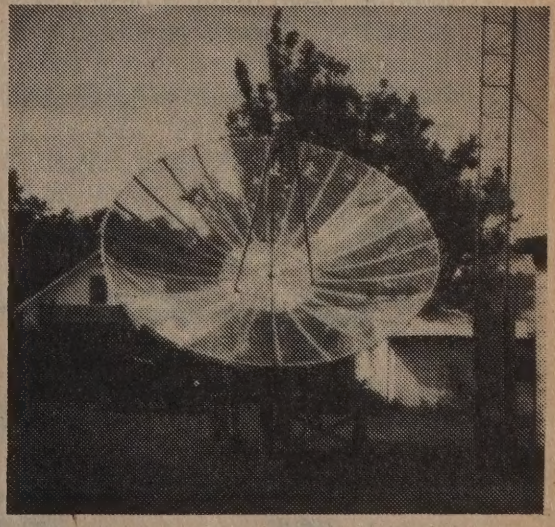
Assembly



Designer Joe, WB9KBJ paints center disk board



Almost completed except for screen wire



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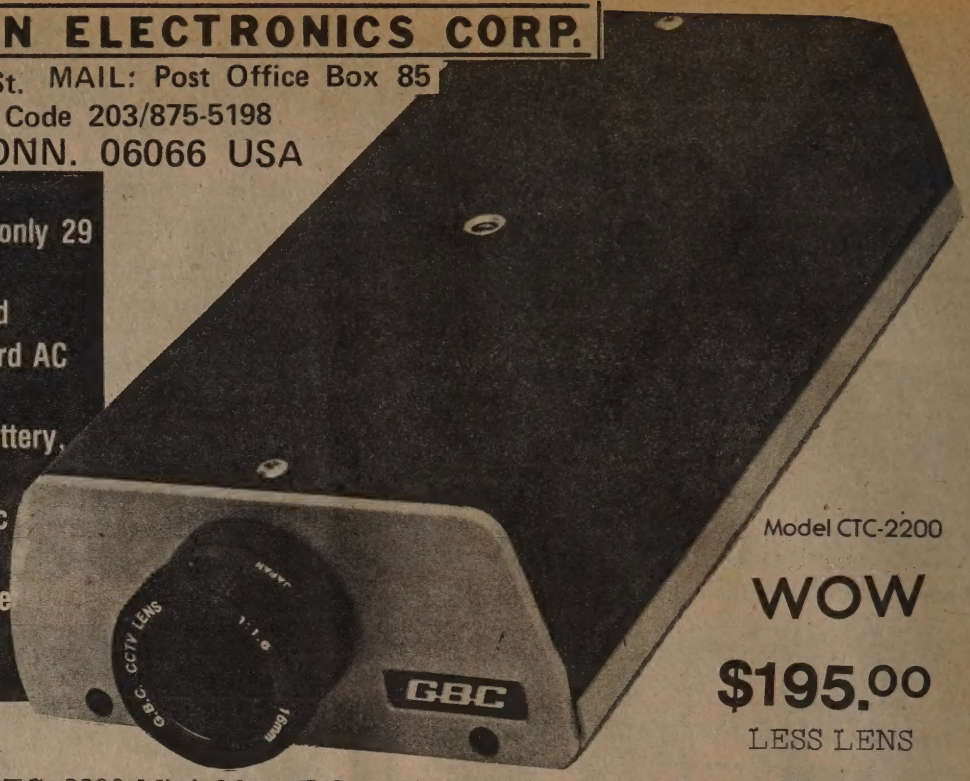

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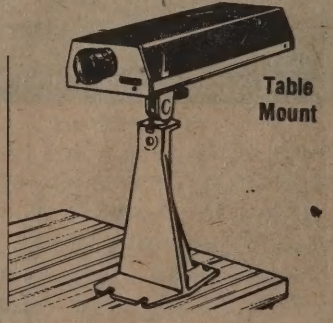

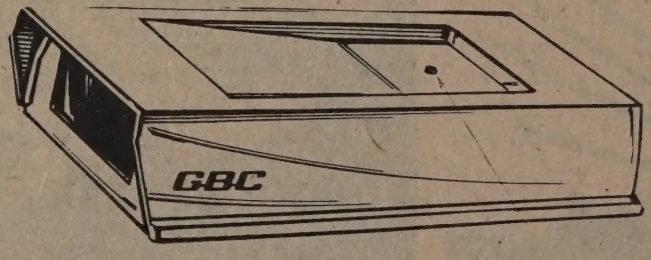

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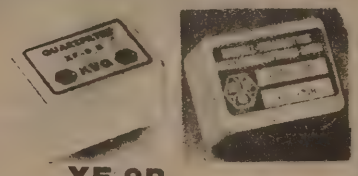

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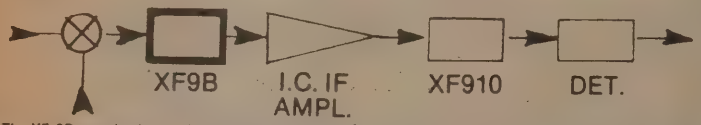

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Insertion Loss	◄3.5 dB	Terminations:	500 ohms
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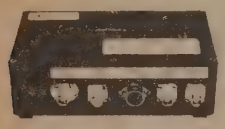
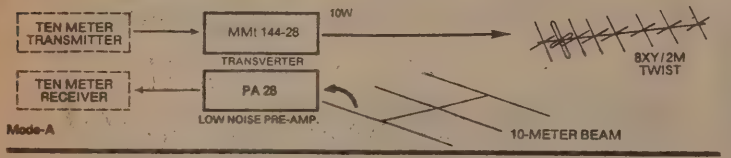
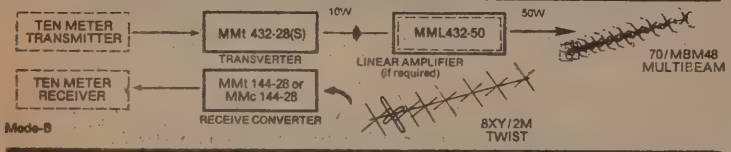
TRANSVERTERS FOR ATV OSCARs 7, 8 and Phase III

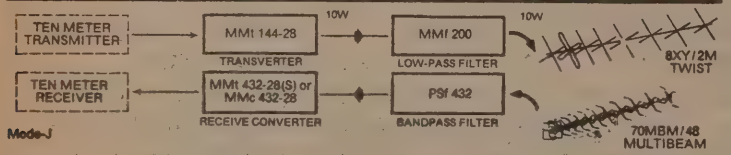


Transverters by Microwave Modules and other manufacturers can convert your existing low band rig to operate on the VHF and UHF bands. Models also available for 2M to 70cm and for ATV operators from Ch2/Ch3 to 70cm. Each transverter contains both a Tx up-converter and a Rx down-converter. Write for details of the largest selection available. Prices start at $199.95 plus $3.50 shipping.

Attention: owners of the original MMt432-28 transverters — update your transverter to operate OSCAR-8 and Phase III by adding the 434 to 436 MHz range. Mod kit including full instructions $26.50 plus $1.50 shipping.







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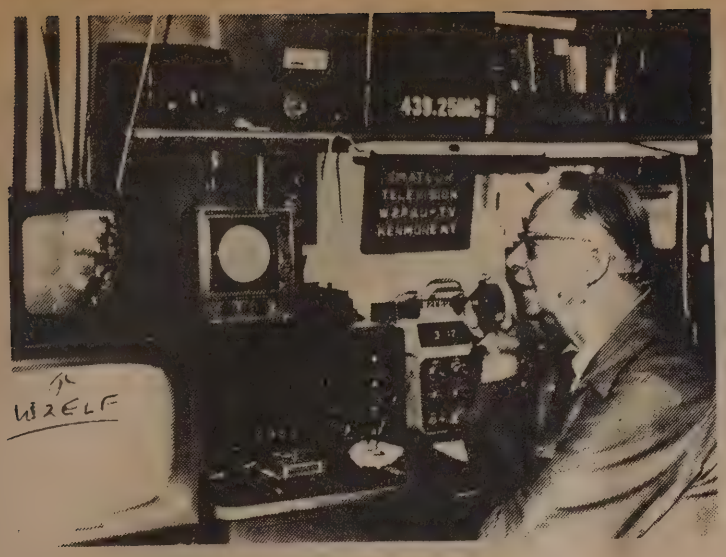

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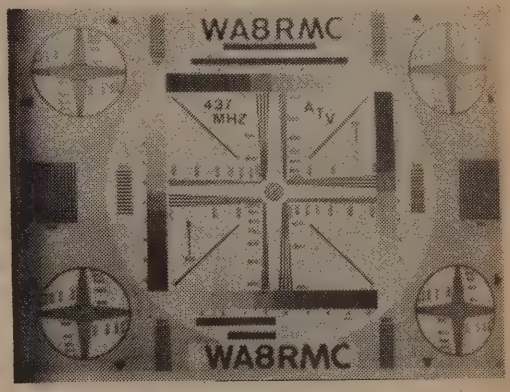

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Watts Handling (SSB)	800	800	500	500

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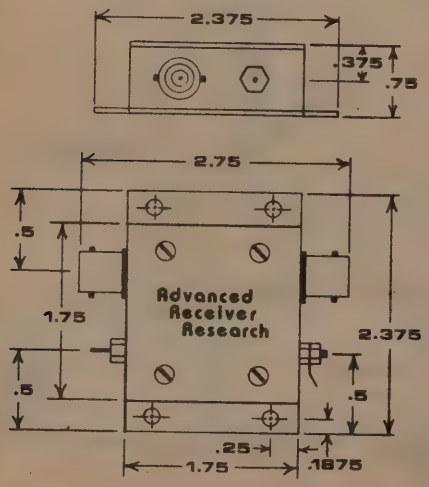
For those of you working with UHF tuners to receive ATV, and for those of you building up your own Downconverters-the P432VD(A) series preamplifiers are exactly what you need! Housed is a very rugged metal cabinet, the model P432VD preamplifier has been designed to cover the 420-450 Mhz. Amateur Band which takes care of SSB, ATV and FM operators on the UHF circuit. They maintain a high degree of rf shielding using a feedthough capacitor for the dc connection. A solder-lug terminal opposite the feedthrough capacitor is provided for the dc ground connection. Each and every amplifier has been precision aligned on quality noise fiqure equipment and is unnecessary for user realignment. The P432VD amplifier has 40 Mhz. bandwidth range, 1.8 db noise fiqure, 15 db of gain, -20 dbm of 1db compression, runs on 10-16 vdc, draws 6ma. and weighs 2 oz. A "hotter" model preamplifier for UHF use is the model P432VDA which also has 40 Mhz. of bandwidth but with 1.1 db noise fiqure, 17 db gain, the same compression levels, voltage draw and weight. The model 432VD was acquired by A5 Magazine and tested on-the-air. A test signal of low power video at 439.25 Mhz. was sent to a PC Electronics downconverter feeding a Zenith model M122P 12 inch AC/DC portable TV set. (PC PA in-line). The signal showed very little improvement against the .9db nf preamp in the downconverter itself. A 2nd test was made using the Zenith set UHF tuner padded to receive 439.25 Mhz. The dramatic results of very snowy and hardly recognizeable picture without the P432VD preamp against the insertion in-line to completely closed-circuit copy was amazing. Further testing with WDØEKP some 41 miles away on ATV proved the same results with P4 quality results. It is felt by the tester that even a P432VD amp placed near the antenna would successfully amplify the incoming signal to give "boost" to any assembled amplifier already in the downconverter system making up the loss received from the length of antenna feedline. Users of UHF tuners need this amplifier to bring out the video signals that are assuradly in noise. Theory of Operation Signals arriving at the input terminal are routed to the base of the low-noise MRF901 (NEC 64535 used in the "VDA" series) UHF transistor through a matching/filter network which provides a 1 db bandwidth of 40 Mhz. centered on 435 Mhz. This network alleviates the need for an external bandpass filter as is necessary with many broadband circuits on the market. The circuit is unconditionally stable and does not require a 50-ohm termination to prevent oscillation. Proper bias for the transistor is supplied by a temperature compensated Zener diode circuit. The positive supply is passed through a .001 uF feedthrough capacitor to maintain effective shielding. Ceraminc chip capacitors are used throughout the device. All claimed specs. were met in test. The operating temperature range is designed for -25 to plus 65 degrees C. The company makes a whole whole line of preamplifiers in the VHF/UHF range including a series of two band converters and Gunplexer systems. Video demodulators and receivers are just coming out and A5 Magazine will review them as they become available. A reputable and quality company & products. . Advanced Receiver Research, Burlington, CT



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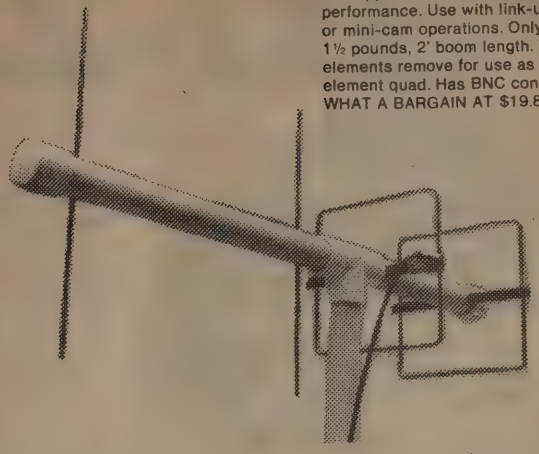

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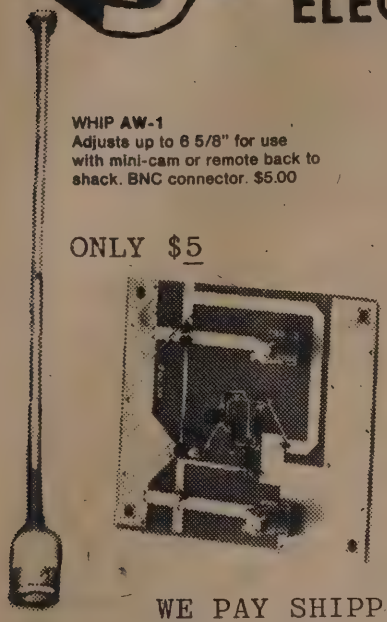

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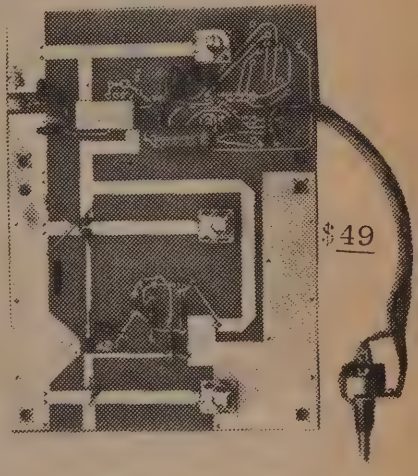

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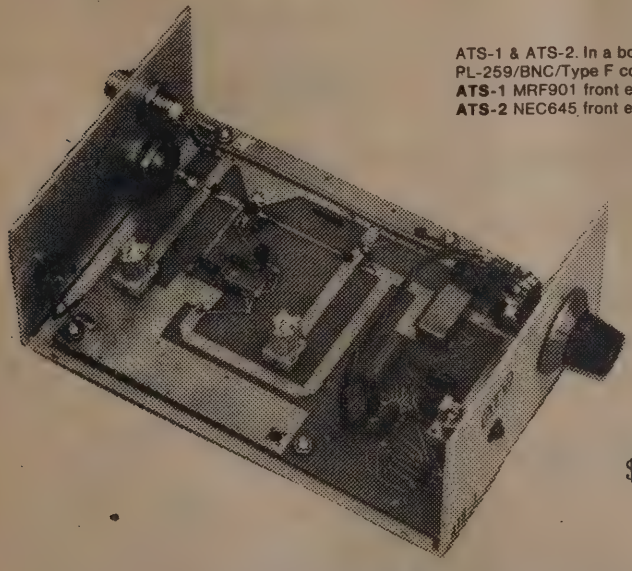
ATS-1 MRF901 front end ... $79
ATS-2 NEC645 front end ... $109.00



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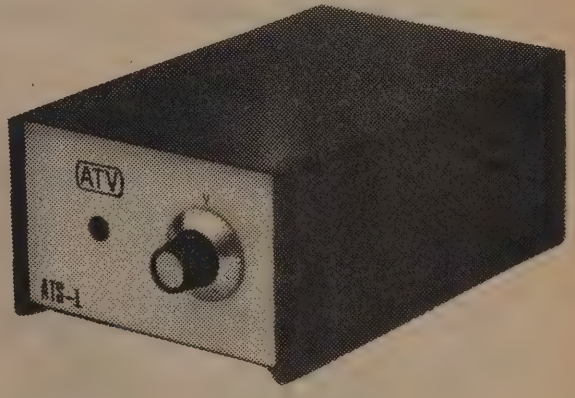
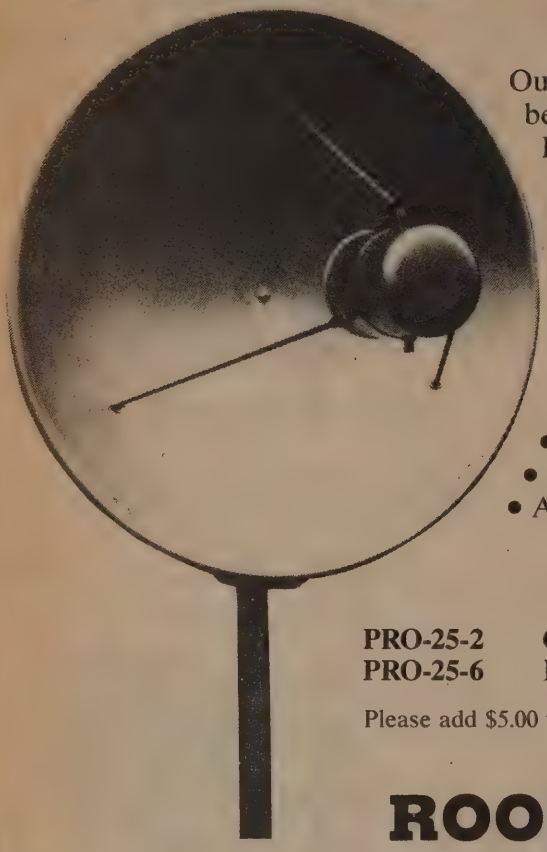


SYSTEM ELECTRONICS P.O. BOX 241
GLEN ELLEN, CA. 95442

PRO-25 MICROWAVE ANTENNA



Our 2.0 Ghz parabolic microwave antenna has been designed to be the ultimate in receiving antennas. It will out-perform the Loop Yagi, the Cigar, the Horn or the Slotted Array antenna by 3 dB or more! The PRO-25 can deliver TWICE the signal power to your microwave ATV down-converter. It can also be effectively illuminated when using the 10 Ghz Microwave Associates Gunnplexer™ transceiver.

Check these features:

- True parabolic reflector
- 13° beamwidth at 2.5 Ghz
- Quality all metal construction
- 25" diameter with 21 dBi gain
- Professional aluminum feed-horn
- An economical alternative to other commercial units!

Call or write for our **FREE CATALOG!**

PRO-25-2	Complete antenna kit	**$69.95**
PRO-25-6	Parabolic reflector only	**$24.95**

Please add $5.00 for shipping & handling.

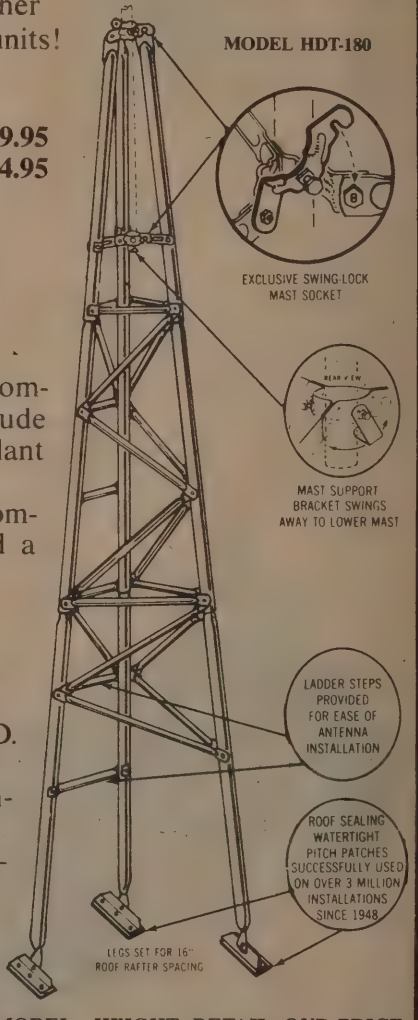
ROOF-TOWERS

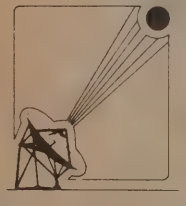
DATA SERVICE COMPANY offers 3', 5', 10' and 15' heavy-duty roof towers which are an excellent choice for making an economical installation of amateur antennas, communication antennas and TV antennas. And if your main tower is already overcrowded, these tripods provide an inexpensive alternative for supporting your VHF and UHF arrays.

The 10' and 15' models feature an integral ladder and unique "swing-lock" mast sockets to simplify antenna installation — no need to balance a mast over the top of the tripod to install it. And you will not have to run to the local hardware store to buy "supplemental hardware" to complete your installation, we include the lag screws and even the sealant with every unit!

Check these features and then compare our prices, you won't find a better value:

- Shipped via UPS
- 90% Preassembled
- Proven leakproof pitch patches
- Legs set for 16" rafter spacing
- Accommodates up to 1¾" O.D. masts
- Integral ladder simplifies antenna installation
- Heavy-Duty Hot-Dip galvanized steel construction


MODEL HDT-180
EXCLUSIVE SWING-LOCK MAST SOCKET
MAST SUPPORT BRACKET SWINGS AWAY TO LOWER MAST
LADDER STEPS PROVIDED FOR EASE OF ANTENNA INSTALLATION
ROOF SEALING WATERTIGHT PITCH PATCHES SUCCESSFULLY USED ON OVER 3 MILLION INSTALLATIONS SINCE 1948
LEGS SET FOR 16" ROOF RAFTER SPACING



DATA SERVICE COMPANY

3110 EVELYN STREET
ROSEVILLE, MN 55113
Telephone: 612-636-9469

MODEL	HEIGHT	RETAIL	OUR PRICE
HDT-36	3'	$ 18.85	**$13.95**
HDT-60	5'	$ 26.73	**$20.95**
HDT-120	10'	$ 70.97	**$49.95**
HDT-180	15'	$100.88	**$74.95**

ANTENNA MOUNTED ATV CONVERTER W6ORG

Antenna mounting the converter will give you a increase in sensitivity equal to the loss of the coax run to the converter in the shack now. If you have a 100 ft run of Belden 8214 now it will give you 3.8 db more. Since the noise figure is determined by the first rf stage and followed with sufficient gain, the coax loss at channel 3 is relatively insignificant. In fact since the frequency is much lower, and therefore less loss in the coax you can run 100 feet of Radio Shack Foam RG6 for only 2 db loss in gain but hardly anything in signal to noise ratio. (Radio Shack 100' with F connectors..RS 15-1527 is $13.99).

The converter and coaxial t/r relay are mounted in a rain proof die cast aluminum 4x7x2 inch box. These are made by Bud (CU-247) and Hammond (1590D). A F connector (RS 278-212) for the converter output and DC control input, and bulkhead type N to RG58 UG 556B/U connectors for antenna and transmit. The N connectors have weatherproofing seals but the F connector and screw holes could leak. So I used a little 5 minute Epoxy over the six screw heads and around the nuts used to mount the converter and Magnacraft W120X-14 coax relay, also the F connector. The box is held in place on the antenna mast with large cable ties and tape. The connectors should be pointing down. Tape the cover seam and screw heads well and the conectors. Then give everything a few coats of clear epoxy spray....no Krylon or acrylics.

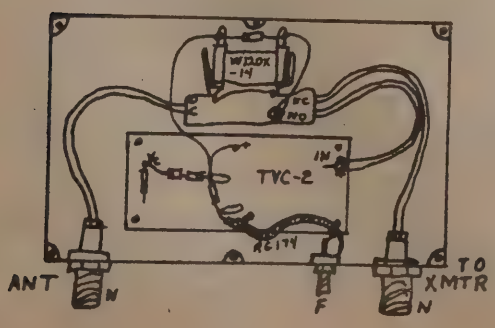
Electrically the receiver is operating when 11 to 18 vdc is passed up the converter output line. This voltage will energize the t/r relay and tune the converter across the band. In xmit the relay is not energized which is a good failsafe against xmitting into the converter and blowing it as well as saving a control cable. The 1N758A 10 volt zener drops the input voltage down to the normal varicap tuning range of 0 to 8 volts. The 1N914 diode in series with the zener helps temperature compensate the varicap. A 4.7 uH RFC isolates the IF from the DC and the .001s block the DC.

A control box must be built to operate the converter system. Most of the parts can be bought thru Radio Shack. The LM317 is a adjustable voltage regulator that must first be set for a minimum output voltage of 11 volts with a PC type trim pot. Do this by setting the panel pot used for converter tuning at zero ohms. You can get fancy by adding a smaller pot for fine tuning or a 50K trimmer across the panel pot to limit the range. Or maybe a meter with freq calibration...a 10V full scale across the panel pot.

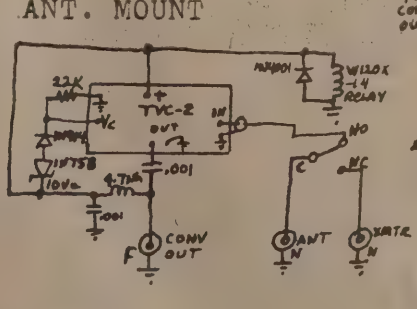
The SPDT 12v relay in the control box will ground the converter power in transmit. Connect one side of the winding to the xmtr + 13.8 VDC that is on only in xmit.

Remove the 10K freq. tune pot. Connect Vc to wiper pad.

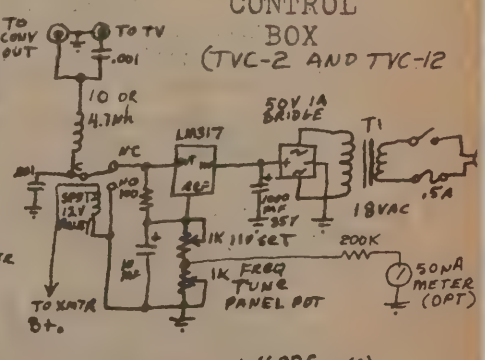
LAYOUT



ANT. MOUNT



CONTROL BOX (TVC-2 AND TVC-12



W6ORG (C)

A5 Magazine apologizes to PC Electronics and their customers for a wrongly placed ad that appeared in the Sep/Oct issue in which some outdated prices were printed. Sorry! -WBØQCD

FAST SCAN ATV

ALL YOU NEED IN ONE BOX

TC-1

Connect to the ant. terminals of any TV set, add a good 450 antenna, a camera, and you are there . . . Show the shack, home movies, computer games, etc.

FEATURES

- 10 WATTS RMS OUTPUT ON SYNC. DC RESTORED MODULATOR.
- STANDARD FREQ. AVAILABLE: 439.25, 434.0, AND 426.25 MHZ SPECIFY XMTR FREQ. AND DOWN-CONVERTER OUTPUT ON CHANNEL 3 OR 2.
- BROADCAST STANDARD 4.5 MHZ SUBCARRIER SOUND WITH HIGHGAIN MIC AMP.
- 8 MHZ BANDWITH MODULATOR FOR HIGH RESOLUTION VIDEO, COLOR, AND COMPUTER ALPHA-NUMERICS.
- BUILT-IN REGULATED AC POWER SUPPLY.
- TUNEABLE DOWNCOVERTER COVERS 420 to 450 MHZ. CONTAINS LOW NOISE .9db NE64535 PREAMP, PLUS HOT CARRIER DOUBLE BALANCED MIXER.
- STILL $399 DELIVERED USA VIA UPS. TWO FOR $750, OR 5 OR MORE 10% OFF.

OPTIONS

- PROVISION FOR EXTERNAL 12 TO 14 VDC FOR MOBILE OR PORTABLE $30
- DM–1 RF/VIDEO DETECTOR MONITOR INSTALLED WITH BNC OUTPUT $30
- ON CARRIER AUDIO MODULE CA–1 INSTALLED FOR THOSE AREAS THAT DO NOT USE STANDARD SUBCARRIER OR TWO METERS FOR AUDIO . . . $50
- TWO FREQUENCY EXCITER INSTALLED WITH XTALS ON 439.25, 434.0, OR 426.25. NOT AVAILABLE WITH CA–1 . . . . . $30

EXTRA LOW NOISE NOW STANDARD AT NO CHARGE!

★ IF YOU WISH TO BUILD YOUR OWN SYSTEM, SEE THE BASIC 4 MODULE PACKAGE.

Our terms are Visa or Master Charge by phone or mail, or check or money order by mail. We do not believe in surcharging hams the cost of unnecessary paperwork from purchase orders, CODs and their returns from unhappy housewives, or unpaid invoices, or dealer markups. We try to give you the lowest price possible to promote Fast Scan ATV.

10-81

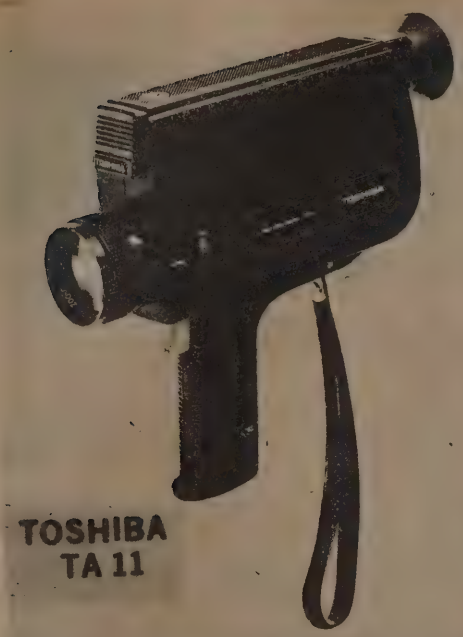
SEND SELF ADDRESSED STAMPED ENVELOPE FOR COMPLETE CATALOG AND ATV INFO. We have all your ATV needs: Antennas, Cameras, Repeaters, Video Monitors, Preamp, Linears, Test Equipment,

P.C. Electronics, 2522 S. Paxson Ln., Arcadia CA. 91006

TOM W6ORG
MARYANN WB6YSS
213/ 447-4565

P.C. ELECTRONICS

ZOOM VIDEO CAMERA



Main Features

- F: 2.5 f = 16 ~ 32 mm Manual zoom
- Optical view finder Through The Lens
- Internal sync. (X-tal controlled)
- 2:1 interlace EIA standard RS330 525 lines
- Built-in microphone

$175 DELIVERED IN U.S.
*Limited quantity available

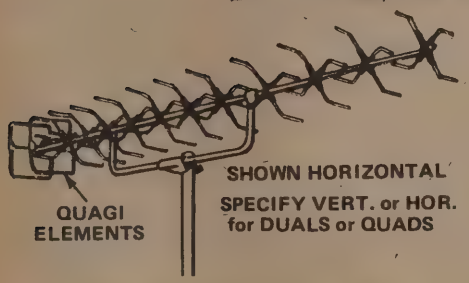
PACKAGE SPECIALS

TC-1 TRANSMITTER/CONVERTER **PLUS:**

*CAMERA
B&W TA11.....560
COLOR GP4B...950
COLOR GP4D..1225

ORDER YOURS TODAY! WE HAVE A LIMITED SUPPLY OF HITACHI GP4Bs AND TOSHIBA TA11s IN STOCK FOR THIS SPECIAL.

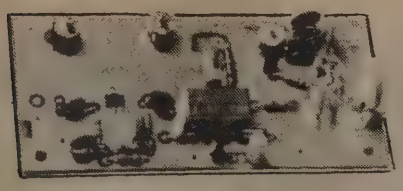
J Beam MBM48/70cm Antenna



ONE OF THE FEW ANTENNAS THAT HAVE ENOUGH BANDWIDTH FOR ATV. . . 3 DB DOWN AT 420 AND 450. COVERS SIMPLEX AND REPEATER FREQUENCIES WITH NO SACRIFICE. NO BALUN TO BUY.

- 15 DB GAIN OVER A DIPOLE. 48 ELEMENTS.
- 6 FOOT BOOM LENGTH
- DIRECT 50 OHM COAX FEED
- 26 DEGREE BEAM WIDTH
- DUALS AND QUADS AVAILABLE

ONLY $ 75.75 + UPS *
* COD OR CHARGE CARD ONLY



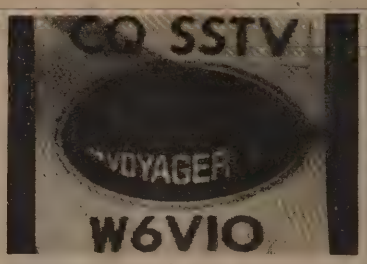
TVC-2 ATV DOWNCONVERTER ..... $55 ppd
Stripline MRF901 (1.7 db NF) preamp and double balanced mixer module digs out the weak ones but resists intermods and overload. Connects between uhf antenna and TV set tuned to channel 2 or 3. Varicap tunes 420 to 450 mHz. Requires +12 to 18 vdc @ 20 ma.
Super sensitive TVC-2L with NE64535 preamp (.9db NF) stage . . . ~~$79~~ ppd NOW $69.00!

TVC-4 ATV DOWNCONVERTER ..... $89 ppd
This is a packaged version of the TVC-2 converter with internal power supply. Has BNC input and F output connectors.
Also available with the NE64535 for ~~$115~~ ppd NOW $105.00!
Size: 5 1/4 X 2½ X 7 inches.

P.C. Electronics, 2522 S. Paxson Ln., Arcadia CA. 91006
TOM W6ORG
MARYANN WB6YSS
8AM - 6PM PDST M-F 213/ 447-4565

W6VIO's SSTV Pictures go around the World

AMSAT



W6VIO's CQ SSTV Card as viewed on the SSTV Monitor. (K6PGX Photo)

Stan Brokl, N2YQ, and Roy Neal, K6DUE, go over a point in the log at W6VIO.

There have been countless articles on the famous W6VIO Club and the JET PROPULSION LAB in Pasadena, California. A5 MAGAZINE takes a look at W6VIO in depth and reports the activities that continue daily at the Club that rarely get publicity beyond the local newsletter.

*JPL Amateur Radio Club W6VI 4800
Oak Grove Dr., Pasadena, CA 91103

If you are a member of W6VIO, or are on the JPL W6VIO Calling-newsletter roster, you will already know that one of the world's leading Amateur Radio Clubs does much more than the highly publicized Voyager Spacecraft encounters of recent. Of course, the space representation is the "highlight" of the Club's goals and deservedly so. But, the Club is much more covering regular meetings of ATV and other modes of communication, sponsoring the WR6APS 22.44 in/224.04 out Repeater, the Closed WR6APR 222.48 in/224.08 out member only autopatch system, holding a regular OSCAR and SATELLITE News Nets every Wednesday at 8 pm., Filed Day participation, VHF Contests, Parade Coverage using Amateur Television Coordination, reporting of FCC activities, great Club picnics, UHF Contests participation, etc., etc. W6VIO is more than a "space club"! Voyager 2, the latest venture for the Club, left Earth on August 20th, 1977 flew by Venus and Mercury, encountered Jupiter July 9th 1979 and Saturn August 25th, 1981. With the spacecraft only 30 miles off course and just seconds off the time roster, Voyager 2 is due to encounter Uranus on January 24th, 1986 and Neptune on August 24th, 1989. It seems a long period of time especially at 28,231 mph. Voyager 2 was 63,000 m. from planet Saturn on August 25th as W6VIO relayed in FSTV and SSTV to Amateurs worldwide. Voyager 1 encounters kept the Club's membership busy 24 hours a day from March 1 to March 11, 1979. Club members worked days, nights and on their lunch breaks to man the station. Those who were able to contact W6VIO and receive the beautiful QSL card will certainly find an appropriate place to display the card proudly on the wall of the shack. This years' pictures from W6VIO were also in Color SSTV thanks to Sam and others (WA7WOD). Those equipped for Color work-were enlighted as the Color pix came on the monitors. Many thanks to W6VIO and JPL from Radio Amateurs worldwide for their devotion and unselfish giving of an historic event that captured the world's attention. Alot of publicity has been generated and W6VIO asks all Amateurs to forward news stories concerning W6VIO including any videotapes of news spots concerning received pictures in local areas by Amateurs. SSTV tapes will make up alot of future transmissions during qso's showing the "captured" frames to those who were unable or missed the events. Work is underway by A5 Magazine to edit and put together the best of Voyagers pictures in cassette form and to be made available to our valued subscribers. Thanks again W6VIO for a job WELL DONE!

K6SVP was the "Honcho" for the W6VIO Voyager I Jupiter Fly-By

jpl

W6VIO CALLING

LINKING ATV FOR PUBLIC EVENTS BY W6ORG

VOYAGER 2 ON FAST SCAN ATV

The operational requirements for JPLs fast scan atv coverage changed from just enabling area hams to see the pictures of Saturn, as I had done during voyager 1, to suppling video to three locations from which the general public can also view. The three locations were the Griffith Park Observatory, the Pasadena shopping center, and the exhibit area of the Planetary Societies Convention.

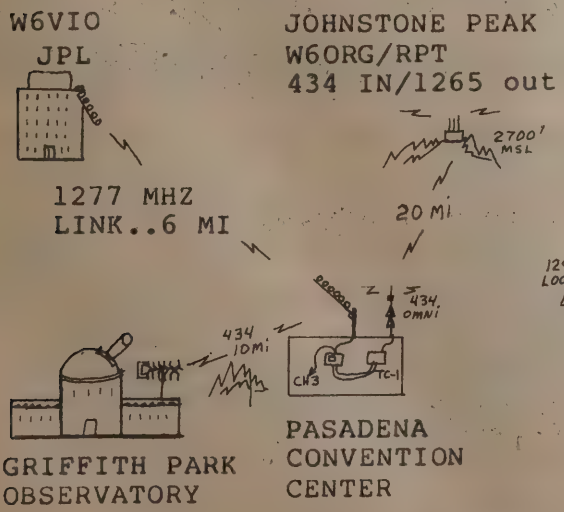
To do this I put my antenna mounted 1277 mHz 8 watt video transmitter atop the Engineering building at JPL. 1296-LY 28 element loop yagis were used at both ends of the 6 mile link between JPL and the Pasadena Convention Center. The output of the 1277 mHz crystal controlled downconverter was split out on channel 3 to the Convention Centers cable distribution system for use of the Planetary Society, and to a TV set/monitor for ATV. The baseband video and audio were tapped out of the TV set and passed over to one of my TC-1 434 mHz ATV Transmitter Converters. To keep from tying up the frequency for 3 weeks continuously, a AC clock timer was set up for specific 1 hour time periods during the day. Also the hams at the JPL ham club, W6VIO, could turn the video off by shutting down the 1277 transmitter. I used one of my TSQ-1 S meter/squelch boards as a carrier operated relay to key the 434 transmitter only when a 1277 signal is being received. The S-meter really helped us line up the loop yagis. The 10 watt 434 video and audio output were sent out on an AEA 450 Isopole omni gain antenna atop the Pasadena Convention center.

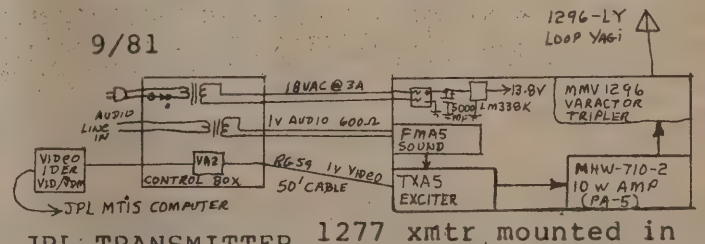
The Pasadena shopping center is right across the street from the convention center so a downconverter and a quarter wave whip were fine there, but at the Griffith Park Observatory, Ernie WB6BAP used a 48 element J Beam antenna into the downconverter and TV to receive good pix of Saturn 10 miles away over some low hills.

Hams in the LA and Orange county area are able to see the high resolution and color video on the 434 repeated output from Pasadena or from the 434 in/ 1265 out atv repeater on Johnstone peak at the 2700' level above the LA basin.

Technically, the system for the link and the repeater are simple as they are made up from P. C. Electronics modules, standard TVs, and antennas that are readily available. The sketches show the geographic layout and the module hookup. Try FSATV at your next public service event?

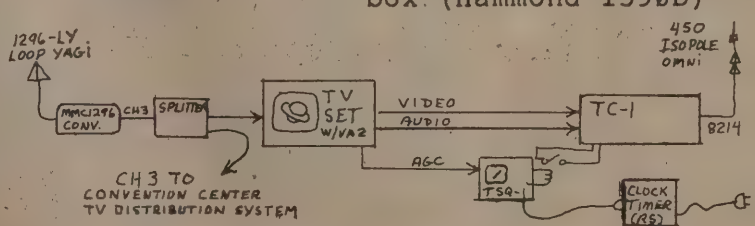
73, Tom O'Hara, W6ORG 9/81





JPL TRANSMITTER SYSTEM

1277 xmtr mounted in 3x4x7 dicast aluminum box. (Hammond 1590D)



CONVENTION CENTER 1277 TO 434 ATV REPEATER SYSTEM

VOYAGER 2 ON FAST SCAN ATV....PHOTO PAGE

1. Maryann, WB6YSS, standing infront of the full scale Voyager mockup will give some idea of its size. The heat converter on the left boom supplies the 400 watts of electricity it takes to run the whole vehicle. The dish pumps out the up to 30 watts RF on 2 and 8 gHz. From Saturn almost a Billion miles away, to the tracking stations in Australia, Spain, and Goldstone, the level out of their dishes is about -130 dbm or less than .1 uv.

2 & 3. A filter wheel is selected and each frame is sent and later, thru the MTIS computer, a composite color picture is made. The Saturn picture shown is thru a orange filter as is noted at its lower left. Besides a grey scale, the input raw white level is shown at the upper scale, and the computer enhanced version is the output below. It takes 144 seconds for the video data stream to make 1 frame of 800 x 800 picture elements of 8 bits each for 256 shades of gray.

4 & 5. Jim WA6MYJ, the JPL ham club video coordinator is shown at the W6VIO ham shack. A WA7WOD modified Robot 400 3 color slow scan system was used for HF contacts. There were over 8000 contacts for Voyager 1 but 11,289 for Voyager 2. Thats a lot of commorative QSLs to fill out!

6,7 & 8. The 1277 mHz transmitter link was set up in the microwave room on top of the engineering building at JPL. Here we tapped into one of their audio and video lines, went thru one of our video IDers (pix shows me adjusting call letter placement on the panel), then thru the control box on the floor next to the monitor. A relatively smog free day allowed aiming down thru the loop yagi to the convention center 6 miles away. A better view of the antenna shows the 1277 transmitter module mounted just below.

9, 10 & 11. Here are Jim and I adjusting levels on the 1277 receive, and the TC-1 434 repeated output. Jim is talking on the JPL club's 220 repeater thru a HT to Jack WB6TXG so he can punch up test patterns or set levels. AEA sent us their first new 450 Isopole off the line to use for the 434 output. We had a lot of help from the convention center administration mainly because Ray, the audio engineer is a ham, WB6STL. You would not believe the crawl ways we had to go thru to get to the roof. Best DX on 434 was to Jim WB6ROP in San Diego about 110 miles snow free one evening. Inside the auditorium the Planetary Society rented an Eidophor large screen projection system to show our link color video to the attendees on a 25 foot wide screen. That evening, over 3000 people enjoyed the video plus a panel discussion moderated by Ted Koppel of ABCs Nightline with author Ray Bradbury, Dr. Carl Sagan from the Nova series on PBS, Gene Roddenberry of Star Trek fame, and Dr. Bruce Murray, the Director of JPL. Amateur radio did get credit for the video. The Planetary Society is a non profit organization of scientists, engineers, and people from all over the world who want to promote space exploration and scientific discoveries. Many are hams and some that I met were from other countries.

12. JPL had a display of 4 other spacecraft at the new Pasadena Center shopping mall. The local Pennys loaned a 25" color set to use at the display. On top of the set is a TVC-4 converter with a 6" whip to receive the 434 video from across the street.

13, 14 & 15. Ernie set up a receiving station at the Griffith Park Observatory for the people taking the Planetarium tour. A 48 element J Beam was mounted on top of the building and aimed at Pasadena. The Saturn picture shows reception there. Ernie WB6BAP is standing next to his display. As tour groups of about 50 at a time passed by the TV, the observatory guides were able to discuss what was happening in real time from the mission event schedule.

.....De Tom W6ORG 9/81

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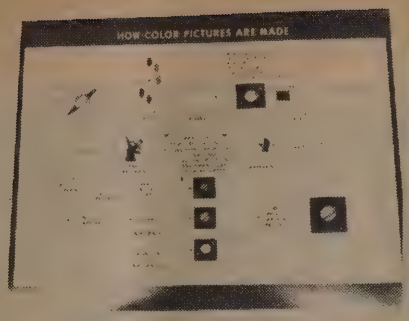

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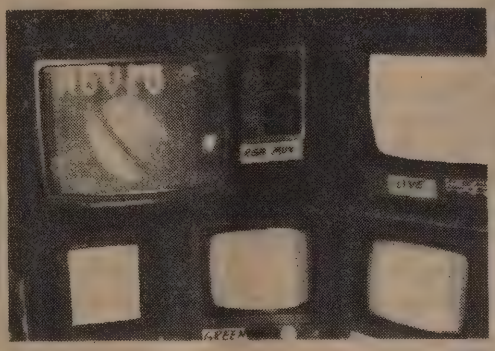

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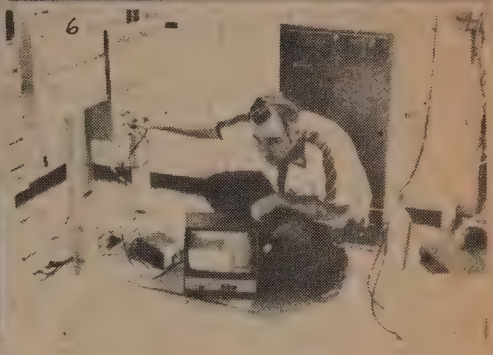

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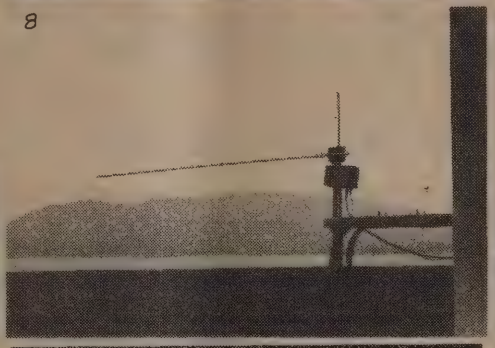

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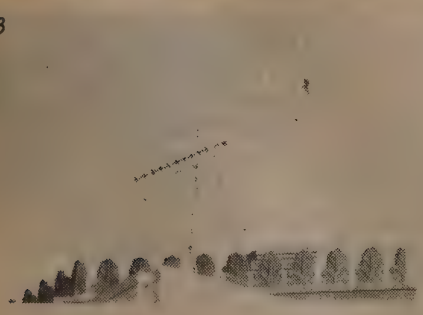


(C) 9-81 WGORG

ROBOT 400 MODIFICATIONS

* *

Mike Stone, WBØQCD

Slow Scan TV

General discussion

*The term "256" used on SSTV circuits is very often misused by misunderstanding operators. "256" in REAL TIME means 256 lines by 256 pixels in one 32 second per picture frame. The ROBOT '300', or P-7 systems, did indeed have REAL "256" capability. But, the ROBOT '400' digital-series converters can only at best (with conversion) send 128 lines by 128 pixels and is translated to 256 by an interlace system. In receiving REAL 256, you pick up every fourth bit (byte) of information in the digital process by running the clock circuit at 1/4 frequency. The modifications shown below will get most of the 256 picture, but not all. This modification is for 1/2 speed 128 format. The line time is the same as 128 at 8 seconds but doubling the time to 16-18 seconds to send a slower picture does not reproduce REAL 256. The so-called "256" term used on-the-air is still 128 pixels and is incorrectly being promoted as REAL 256. It is really 128 sent at half speed. Now that we have you totally confused, lets continue on with the article!

Advantages of this ROBOT modification (128 at 1/2 speed)

'256' transmission in SSTV mode is far from being anything new. Earlier equipment did indeed have capability for 256 line transmissions. WB4HCV's November 1978 article modification detailed the same basic conversion as shown below-using a switching network between two IC chips. This conversion is much simpler and does not involve interconnection to digital components except for STEP-2. The "mod" allows 128 at 1/2 speed and 64 line "minipix".

This modification offers two basic advantages; 1-longer frame time and slowing of each 128 lines of information provides a better "QRM" or "QRN" copy of the finished product. A brief burst of static, unwanted voice modulation or carrier-tuner upper will wipe out a major portion of an 8 second frame. The same interference will perhaps not even be noticable or at a much less degree of destruction on a 16 second frame. 2-this modification allows the operator a multiple of "special effects artwork" including split-photo and dual-stacking techniques. The complete modification consists of two separate steps and is relatively simple with no special tools needed.

STEP-1 RECEIVE/TRANSMIT 128 line 1/2 speed
by WA7WOD and WA4OAA (OCT 79)

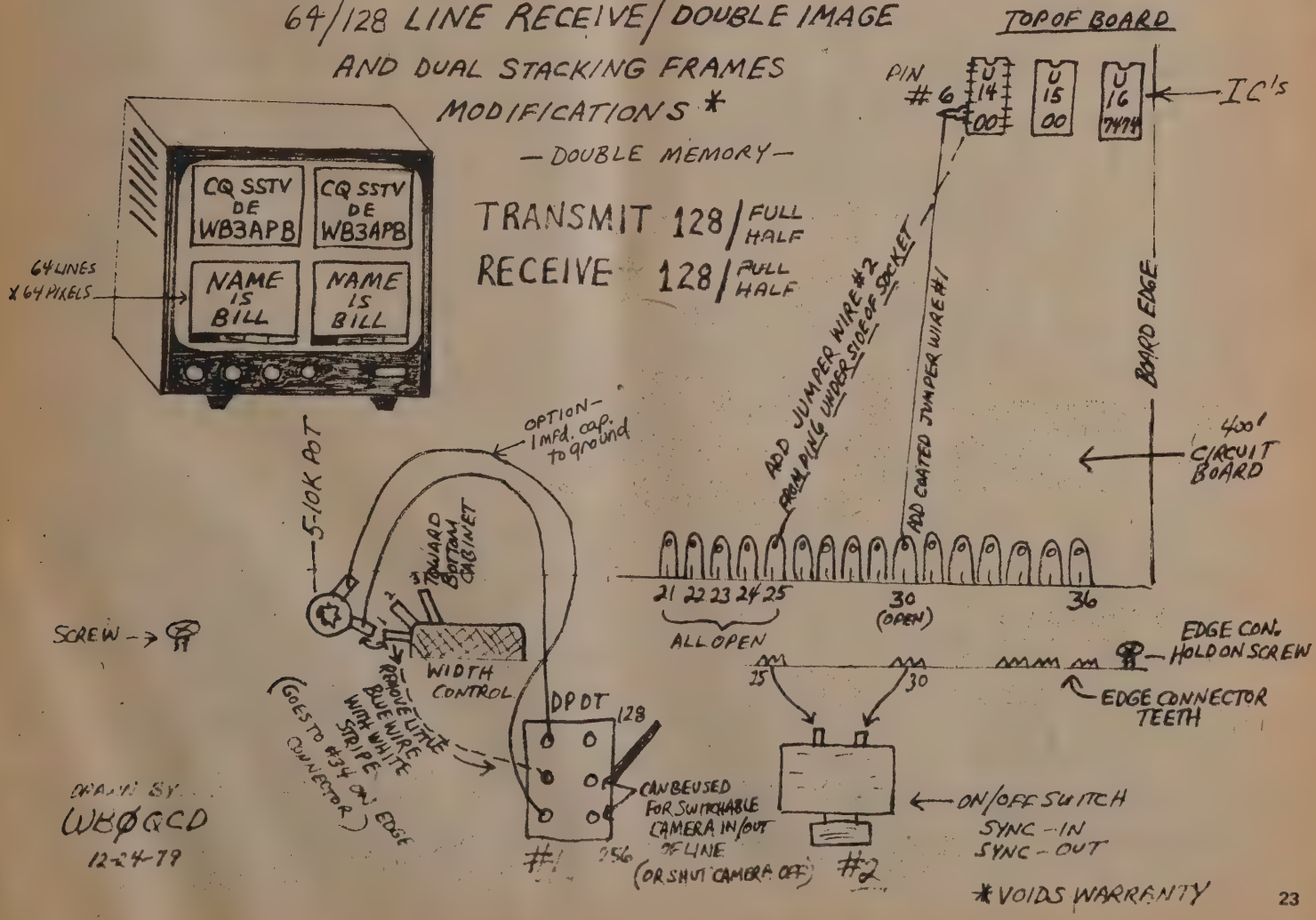
To receive 1/2 speed transmissions, install a 5-10k pot in line with the factory "width" control pot located on the front panel of the '400' converter. The new pot may be soldered directly to the terminals of the width-control pot for additional support or elsewhere for external mounting. Remove the little blue and white striped wire from the topmost width control pot arm and insert the new pot in line. The blue/white wire goes to the common portion of a DPDT toggle switch. Arrange the new pot so you can adjust the pot for alignment while watching the monitor TV. If outside, external mounting is desired see note (1). A pair of wires from the two positions of the DPDT switch go to each side of the new pot. With the '400' factory width control pot set for normal 60 hz. signal reception, adjust the new pot while in '64' position for exactly two duplicate frames (see note (2). The switch now gives 64 & 128 line receive capability. If a station sends a regular 128 line picture with the switch in 128 position-a normal frame is painted. With the switch in 64 position, two duplicate pictures-smaller and side by side is painted. A combined picture of the first

frame is in 128 position and the second frame (same or different picture) while in 64 position achives unique results. Additionally, a 16 second-128 picture sent will paint a full-frame with the switch in 64 position or "QRM" mode.

To transmit out (128 at 1/2 speed), (full frame-single picture) using the remaining connectors of the DPDT switch for breaking the CAMERA circuit line or turning off the AC to the CCTV camera used or disconnecting of the plug, freeze a 128 frame picture (or any 64' line picture received) by the usual MEMORY INPUT "HOLD" position and with the DISPLAY switch to CAMERA position you will notice that the CCTV monitor goes blank and eractic. With the usual output of video signal activated by the MEMORY position of TRANSMIT SELECT, the picture stored in memory goes out at twice the normal rate of scan or about 18 seconds. The operator can tell when the frame has completed or cycled by watching for the blinking that occurs on the screen after the grey scale. Receivers with "monitor" circuits of sampled RF ouput may also be used. Note that only one frame-picture may be sent at a time unlike continuous taped programs.

ROBOT 400 SSTV CONVERTER

64/128 LINE RECEIVE/DOUBLE IMAGE AND DUAL STACKING FRAMES MODIFICATIONS *



4 PICTURES PER FRAME IN YOUR ROBOT 400

SIMPLE MOD FOR 4 MEMORY 400! by KD6HF

SEND MINI-COLOR!

ROBOT '400 MOD FOR STORAGE & TRANSMISSION OF FOUR SEPARATE & DIFFERENT SSTV PIX

By popular demand, I am giving my method for receiving, storing and transmitting four complete and different slow scan pictures in one robot '400. The format for each picture is 64 pixels x 64 lines.

WB3APB Bill has experimented with this and other '400 mods and much interest has been generated. You will enjoy using this modification and be pleased with the results.

Many special effects are possible with this mod; i.e., superimpose received video over your own camera or taped video. Store any color format SSTV from WA7WOD, W9NTP, G3NOX or others in one memory and retransmit the color shots to produce a 2x2 color display of the video you received, four color pix from one memory. More uses for this mod in a bit.

Refer to Fig. 1 to see the relative size and location of the four quadrants on a '400 display. Each quadrant is individually accessible, just like having four individual memories. As mentioned before, each picture is formated into a 64x64 display.

The quadrants may be selected one at a time for retransmission or all four may be sent in normal manner. Either way, the receiving station will see four pictures at the same time.

The effect is like the frame multiplying or 256 modification put out by WA7WOD and WA4ØAA in A5 Magazine. In fact, if you do not already have that mod, refer to vol. 10, no. 2, March-April, 1980, p. 28. You will need to install it in order for this mod to work properly. I have included the schematic of that mod but not all the details.

How it works: Refer to Fig. 2.

Switch S1 is a DP5T wafer type. One section, S1-A, is wired between IC U24 pin 12 and IC U21 Pin 3. The other section. S1-B is wired between IC U41 Pin 12 and IC U37 Pin 10.

IC numbers refer to chips on the '400 using robot's designations.

S1 selects in Position 1 (normal), the digital address signals from U24 and U41 as inputs to the memory address multiplexers U21 and U37 respectively. This is for normal '400 operation.

In positions 2 through 5, combinations of +5 volts and ground are routed as inputs to U21 pin 3 and U37 pin 10, such that each switch position selects a different quadrant for storage in ¼ of memory and/or transmission of a slow scan picture.

In order to store a complete slow scan picture in each quadrant, the slow scan clock U6Ø, must be slowed down to one-half normal rate, i.e., appx. 1.Ø43 kHz. This may be accomplished by dividing U60's out by 2 (see fig. 3). With this method, some provision for switching out the divide-by-two for normal operation must be made.

A simpler way is to install the 256 mod mentioned earlier.

Fig. 4 shows the schematic for this.

How to wire it: Refer to fig. 2 and robot layout.

Parts Needed

1. 1-DP5T wafer switch non-shorting type
2. Several feet of hook-up wire
   a) wire S1A positions 2 and 3 together. These two connections go to ground in the '400.
   b) wire S1A positions 4 and 5 together. These go to +5x in the '400.
   c) wire S1B positions 2 and 4 to chassis ground and positions 3 and 5 to +5v.
   d) connect a wire from S1A position 1 to U24 pin 12 on the bottom of the circuit board at U24's socket.
   e) connect a wire from S1B position 1 to U41 pin 12 on the bottom of the board at U41's socket.
   f) take out U21 and gently bend pin 3 out at a 90° angle to the IC.
   g) carefully solder a small gauge wire to the bent-out pin. The other end is soldered to S1A wiper terminal.
   h) Place U21 back in its socket, leaving Pin 3 bent out.
   i) likewise, lift pin 10 of U37 out and run a wire from pin 10 to S1B wiper terminal.
   j) replace IC U37 leaving pin 10 bent out.

This completes the wiring unless you still don't have the 256 mod installed.

The wafer switch S1 may be mounted where convenient. Mine hangs out the side (typical) of my home brew '400. WB3APB, Bill, has his in an external box. K5KFC, Mitch, put his on the side of his HCV scan converter.

I have a circuit which retransmits the ¼ frame pictures as a full-size 128x128 and have used it on the air with K5FKFC and KA5AAP. However, I don't have documentation on it. So look for a circuit board to come out of this in the future.

How to operate it:

I will assume that the 256 mod has been installed.

The first thing to do is calibrate the '400 front panel width control and then the 256 mod width trimmer will be set next.

Begin by placing quadrant select switch S1 (Fig. 2) in position No. 1 (normal). Now place 256 mod switch (#1 in fig. 4) in the 128 position and tune in an SSTV signal or use one of your tapes if your record/playback speeds are the same. Adjust width control on the front panel of the '400 for proper width of a 60 Hz slow scan picture. Next switch 256 mod switch (#1 in fig. 4) to the 256 position and adjust 246 mod pot (R256 in fig. 4) to produce a display which is exactly two pictures wide.

When the above procedure is done properly, the constrols should not need further setting when switching between normal 128 line video and 64x64 video. Also, the slow scan clock U60 will be properly set for both modes.

With S1 in normal, the '400 and the 256 mod will function as usual.

Now place the 256 mod switch in 256 position and S1 to position no. 2. This will select quadrant no. 1 for viewing and storage of the slow scan signal. Note that whatever video is in quadrants 2, 3 and 4 will be held in memory regardless of the '400's hold-continue position. When the switch is put into continue, quadrant no. 1 will fill up with video. Freeze a frame and switch to quadrant no. 2 (position no. 3 of S1). Switch back to continue and freeze a frame in no. 2 quadrant. Proceed to fill up quadrants 3 and 4 leaving the hold switch in hold after no. 4.

Now sit back and smile big!!! Look at those pictures - Hi!!

For standard 128x128 reception, switch 256 mod switch back to 128 position and S1 to normal.

To transmit from memory there are two ways. One is to transmit all four quadrants at once as in normal transmissions. The other is to select any one quadrant by using S1 (256 mod does not affect transmission except for one instance which is covered in the A5 article mentioned). When transmitting from one quadrant, the picture is sent in the same format, i.e., 64x64 with two pictures on top and two on bottom, all being whichever quadrant picture is selected. For use in color SSTV, load the red, green and blue pictures in three of the quadrants (or only two quadrants in the case of two-color systems). Next, retransmit each color separately by using S1. The receiving station will see four "living color" pictures at his end. I have worked WA7WOD and KA5AAP in this mode and results are great.

This mod has so many uses that only a few are included here. No doubt your imagination will provide many hours editing new tapes. But here are a few ideas to get you going.

Superimpose your XYL's picture in one corner with a full size shot of yourself.

Use three of the quadrants to hold incoming video and the fourth as a real time monitor so you don't miss any shots while waiting your turn in a QSO.

Store pictures from different stations and then retransmit them all at once. (Sit back and wait for the questions).

Good look with the mod, hope you like it.

73 - Mac KD6HF

KD6HF

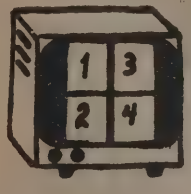


Fig. 1

REPRESENTATION OF SSTV MONITOR SHOWING LOCATION & NUMBERING OF 64x64 QUADRANTS. FOUR DIFFERENT PIX MAY BE STORED IN ONE '400 MEMORY.

ROBOT 400 MOD*

STORE 4 DIFFERENT SSTV PIX IN ONE MEMORY

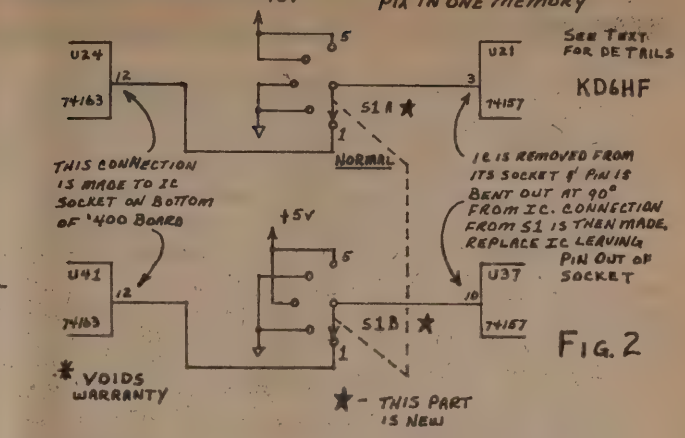


Fig. 2

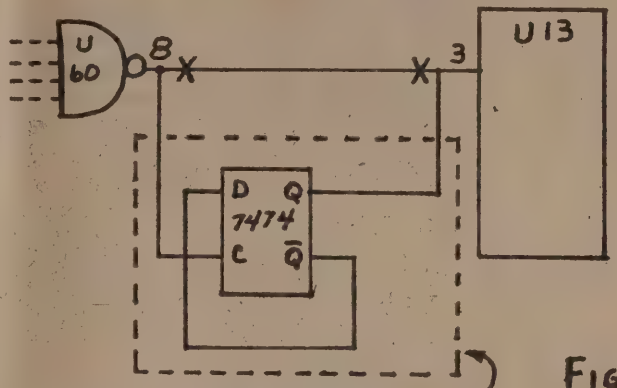


Fig. 3

KD6HF

THIS CIRCUIT WILL DIVIDE U60 CLOCK BY 2 SO THAT 4 DIFFERENT PIX' MAY BE STORED IN ONE '400. TEXT PROVIDES FURTHER DETAILS ON THIS MOD.

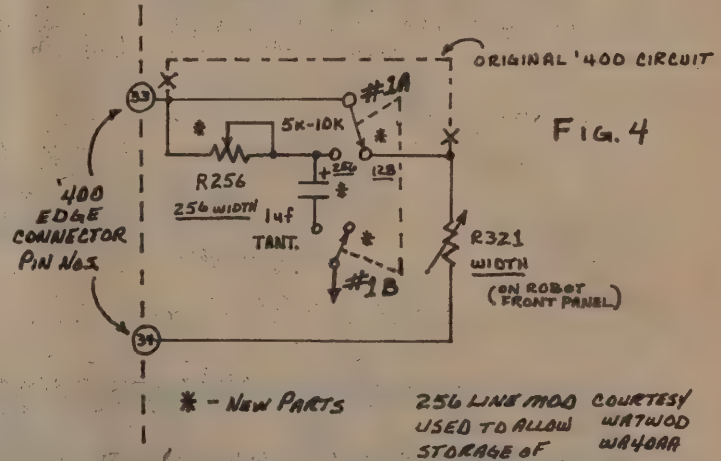


Fig. 4

* - NEW PARTS

256 LINE MOD USED TO ALLOW STORAGE OF 4 DIFFERENT SSTV PIX' IN ONE '400

COURTESY WA7WOD WA4OAA

SEE TEXT BY KD6HF FOR THIS NEW MOD

WANT MORE? **LIGHT PEN FOR YOUR 400. DRAW & WRITE ON A TV SCREEN — DIRECT INTO MEMORY 6**

NEW SSTV 3-MEMORY COLOR SYSTEM BY KD6HF

UPGRADE YOUR ROBOT 400 WITH THIS UNIQUE BOARD

Amateur Television Magazine

With COLOR SSTV interest at a peak, a better method was sought to reduce the cost of the equipment needed to receive and transmit COLOR pictures over-the-air without having to buy three converters. Announcing the model #3000-C 3-memory SSTV converter board system that plugs right into your present Robot 400 converter and can be mounted inside the case! The new board, designed by KD6HF and tested by WA7WOD, can snatch red, green and blue video from a demodulator (by TV circuitry) color camera or from the "filter" method using a black/white TV camera. This is accomplished by multiplexing the red, green and blue signals on a frame-by-frame basis. This method, utilizes only one A/D converter in the Robot 400. Alternatively, the three inputs may be tied in parallel for feeding the B/W camera. The memory chips in the model #3000-C board are 4116 type, 16K RAMS, with 4 RAMS making up each memory, 12 IC's in total. Only two switches are added to the Robot 400 for COLOR operation. One switch is for manual multiplex control while the second is for controlling the "memory write" in the manual position and "memory read" in the SSTV transmit position (3 position toggle switch). For non-COLOR work, 3 independent SSTV pictures may be stored in the memories using the multiplex mode with all other factory Robot controls funtioning normally. The model #3000-C board contains a total of 40 IC's and 6 transistors and is mounted beneath the original Robot 400 board. Interfacing is done via 4-pin DIP jumpers and a double readout 22/44 edge connector. A complete step-by-step instruction manual is provided with the sale of each board system. SPECIFICS OF SYSTEM: The original Robot 400 memory chips are removed, as well as the 3245 driver chip. The memory output multiplex chips and several other IC's are removed as they are not needed in our modification system. All of the memory address-chips are located on the #3000-C board with connection to the Robot 400 through DIP jumpers. Memory input data and red video output data, as well as all SSTV data goes thru the VCO via a 16 pin jumper. We have utilized as much of the original 400 circuitry as possible. In doing this, while in the "live" camera position, the color display on the monitor is multiplexed on a line-by-line basis due to the use of the single A/D converter. Preview of camera shots may be seen this way with all controls in original positions as on the black/white version. This "live" color-multiplexed display is only possible when using a color camera, otherwise the "preview" is seen on a frame at-a-time basis. The Red, green and blue frames are switch selectable with the three position system. To transmit a COLOR SSTV picture loaded into memories-the 3 position switch is first placed in red memory position until the desired numbers of frames are sent using the flicker cue method. The remaining color frames are sent in RGB sequence with each frame sent in sync for perfect registration. COST OF SYSTEM: The model #3000-C 3-memory board comes preassembled, aligned and tested before it leaves the factory. It has with it a prewired edge-connector, DIP jumper cables, two switches, four extra BNC jacks a 2 5/8 inch cooling fan, all hardware and a complete instruction manual. The cost is $450.00 US. In comparison to the present popular method of using 3 Robot 400's to attain the same results, it is quickly realized the savings involved. Optional is a 9 inch Color TV Set, modified to accept red, green and blue inputs and to provide demodulated RGB video outputs to the #3000-C board system. Price $549.50. If a black/white camera is to be used with filters, the color 3 memory outputs may be run to a color RF modulator for antenna entry to any unmodified color TV. See you on COLOR SSTV! KD6HF

KD6HF HOWARD

INTERFACE SYSTEMS

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Amateur Television Magazine
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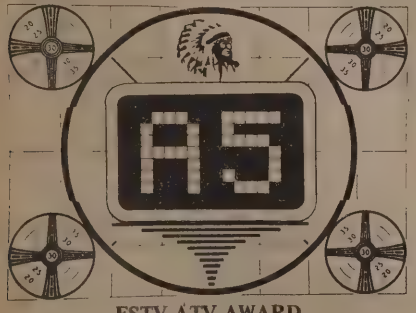

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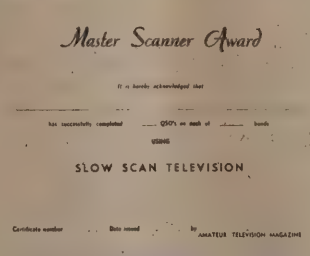

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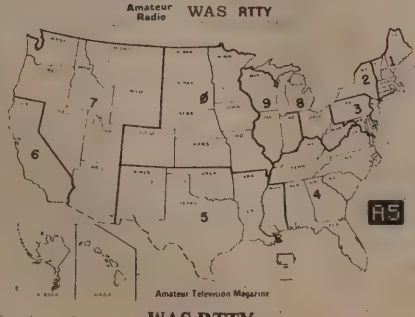


WAS RTTY

GOOD IMAGE AWARD

The G3OQD light pen for the Robot 400

by M. H. EMMERSON, MSc, Grad IERE, G3OQD*

Obtained and reprinted with permission RSGB Radio Communication Mag.-WBØQCD

Introduction

The light pen is a device for writing captions, cartoons etc directly on the tube face of a fast-scan tv monitor connected to the output of an sstv scan converter, in this case the Robot 400. The idea is not original, having been first seen by the author when in contact with a Continental station using a commercial DL2RZ-designed SC421 scan converter. As no circuit details of this system were available, it was decided that a light pen should be designed to work in conjunction with the author's homemade version of the Robot 400. From this initial decision it took a considerable time to produce the circuit described here; the reason for which will become apparent in the following description of how the circuit operates.

Theory of operation

The basic principle of operation of the light pen is quite simple. When light from the spot forming the line-scan raster passes a photo transistor, a pulse is generated which writes into the scan converter memory.

In practice, however, there is a problem due to the response time of the photo transistor. This delays the write pulse, so that the writing appears shifted to the right from the pen position. This was overcome by delaying the write pulse by a little less than one line time, so that writing actually occurs on the line below the one detected, at a position corresponding to the actual pen position. This delay is conveniently obtained by using a dual monostable with the time delay of the second one being trimmed to enable the writing position to be adjusted to coincide with that of the pen. Two monostables in series are used, because using only one would require an excessively high duty cycle.

The next problem concerned the thickness of the writing and the sharpness of the line that could be obtained. The thickness seemed to be affected by the screen brightness, and the sharpness could be improved by restricting the angle of view of the photo transistor to the screen. At this stage in the design it was decided to try some logic processing of the pulse from the photo transistor, before it was used to write into the memory.

Processing takes two forms: first, only the fast rising edge of the pulse from the photo transistor is used. Then the writing width can be set by using a programmable dead-end counter (reset after each line) to count the number of pixels to be written into on a particular line.

Second, as the photo transistor will be able to "see" a number of lines in the vertical direction, it is desirable to restrict the number of detected lines that actually cause writing to occur. The first line "seen" by the photo transistor will not be fully in view and will therefore not be as reliable in timing and amplitude as those directly in view. A programmable counter (reset after each frame) is used to ignore the first line detected and then, by decoding the outputs of the counter, the counter can be stopped after the desired number of lines have been written on. It should be noted at this point that each line stored in memory is displayed twice by the Robot 400 on the monitor screen. The practical significance of this is that when writing into two lines of memory, three detected lines from the monitor must cause writing to memory, increasing to five for three lines in memory.

The above processing gives the means for determining the writing thickness in both the horizontal and vertical directions, and it was therefore decided to include a switch to select writing thickness and, hence, make the unit more versatile.

Circuit description

Video amplifier. The video amplifier consists of two parts, the first of which is housed in the light pen itself. This uses the photo transistor PTR1 and TR1 in a cascode arrangement which has the advantage of fast response to changing light levels. Video output is fed down the light pen cable by emitter follower TR2, acting as a low impedance line driver. A further amplifier is used at the other end of the cable to provide sufficient voltage level to operate the comparitor. AC coupling is necessary in this stage to prevent any steady voltage level, due to ambient lighting, from operating the comparitor.

Comparitor. The 311 comparitor, IC1, is used to detect the small pulses received from the video amplifier and convert them to ttl logic level pulses. The threshold is adjustable so that it may be set to respond to the video input, yet not to respond to any noise level present.

Logic. The positive going pulses from the comparitor clock the latch IC2a, which is held in the clear state by IFHB from the Robot 400 to prevent the latch from being clocked by any noise present during the video blanking time. Clearing the latch in this way prevents the output from the comparitor causing writing to occur in more than one position along a line, further improving noise immunity. The positive-going edge from the Q output of IC2a triggers the monostable, IC5a, which in turn triggers the adjustable monostable, IC5b.

This operation is, however, inhibited by a high level on the "A" input of the first monostable (pin 1 IC5), provided by the inverted (by IC7d) Q_D output of the counter IC3. This counter is clocked by the positive-going edge of the $\overline{Q}$ output from the latch, IC2a, occurring at the end of the line that IC2a has been clocked. The preset count, loaded into the counter (IC3), determines the number of detected lines before writing is enabled by Q_D (pin 7 IC3) going high. The circuit shows a preset count of 7 and, as writing starts when a count of 8 is reached, this circuit will ignore just the first detected line. The number of ignored lines may be increased (taking "A" low gives 2, "B" low gives 3 etc), but it must be remembered that if too many lines are ignored then there will not be enough left to give thick writing at low brightness levels.

The number of lines upon which writing can take place is determined by the decoded (by IC4) outputs of IC3. The selected decoded output is used to prevent latch IC2a changing state when clocked, and an inverted version from IC7f inhibits IC3 from further counting.

Horizontal writing width is determined by the counter IC6 which is preset to the number of pixels to be written on. Writing is initiated by the rising edge of $\overline{Q}$ from the line delay

*35 Hartfield Crescent, West Wickham, Kent BR4 9DW.

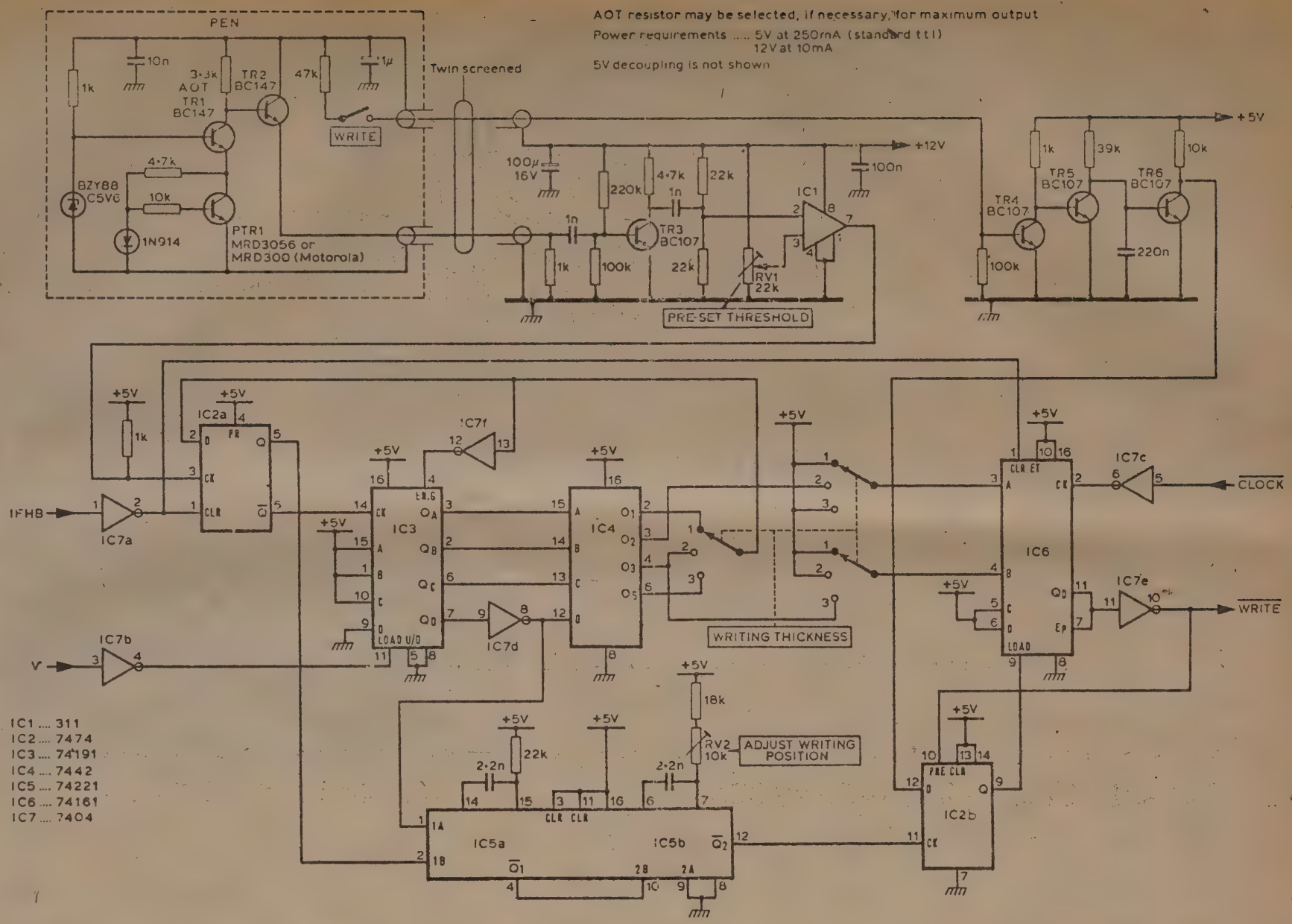


Fig 1. Light pen circuit (for Robot 400).

A5 Magazine has arranged for the basic parts of this article to be available via ALPHA LABS at a very reasonable cost. See ad in A5 Classifides.

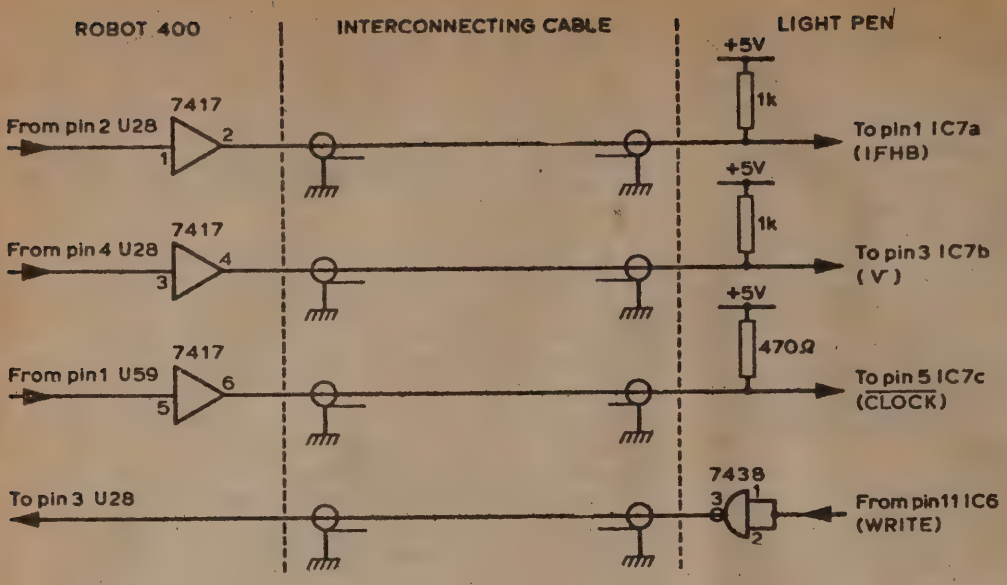


Fig 2. Interface circuit

circuit IC5b clocking the latch IC2b, causing its Q output to go low and load the counter IC6. This operation is only enabled when the D input of IC2b is pulled low by TR6. The delay network between TR5 and TR6 prevents writing until after any contact bounce in the write switch.

As the modified Robot 400 requires a low write enable pulse, this is obtained from the inverted (by IC7e) Q_D output of the counter IC6. This counter is initially cleared to zero by IFHB and prevented from counting by the low Q_D output being connected to the enable input EP. When the counter is loaded, Q_D goes high, removing the load input by pre-setting the latch IC2b. The counter will now be clocked by the pixel clock from the 400 until Q_D once again goes low and inhibits further counting. In the thick and medium writing selections, the counter IC6 only writes the full horizontal width on one line; this is achieved by programming the counter from the decoded output of the line counter IC3.

Construction

Construction is in two parts, the pen and the logic board; the construction of the pen being the most critical. There are many forms that the pen could take depending on the preferences of the constructor; however, there are two important points, the positioning of photo transistor in the tip of the pen, and screening the amplifier to exclude any rf. The problem with the photo transistor is to mount it in such a way that the field of view is restricted to the area in front of the pen tip. In the prototype the photo transistor is mounted in a small tube of ptfe to provide a low-friction contact with the glass of the crt. The effects of reflections from the walls of the tube are reduced by having a small aperture in front of the photo transistor lens. This problem could also be reduced by making the tube shorter but without letting the diode lens touch the screen.

The prototype pen consists of a 0·5in diameter copper tube 5in long, with the pen amplifier being constructed on a narrow piece of Veroboard using miniature components, so that it may be slid into the tube. Writing is controlled by a miniature microswitch with a small cut-out in the side of the tube to allow the actuator to be pressed. The photo transistor mount was constructed from a cut-down right-angle BNC plug; this also, fortuitously, contained the necessary ptfe tube. The cable grip at the other end of the pen is also made from an old BNC plug, the body of which was found to be a push fit into the tube.

The logic section of the pen can be housed within the 400 or in an external self-contained box. The latter option was chosen for the prototype because there was insufficient room on the front panel for the writing thickness switch, and, as it was proposed to add two more memories to the scan converter, any further demands on the power supply were considered undesirable. If the logic is to be mounted within the 400, the "LS" series ttl should be used to reduce power consumption, also it is possible to permanently wire the medium writing thickness to avoid drilling an extra hole in the front panel.

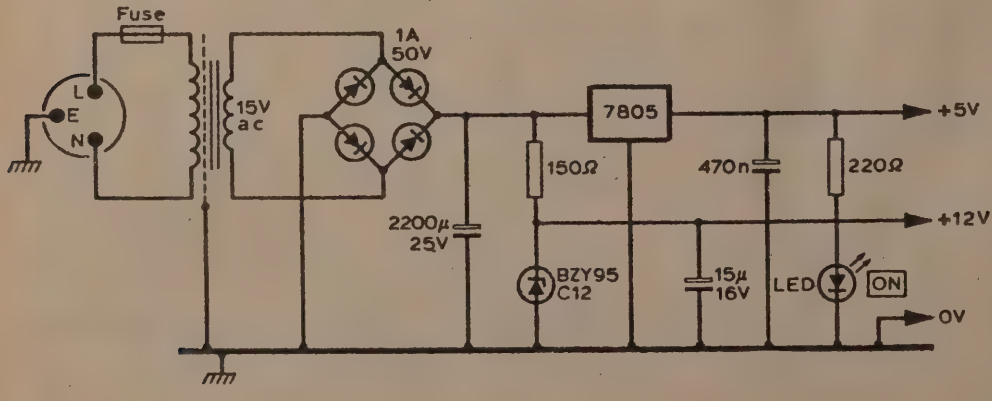


Fig 3. Power supply

With the logic mounted externally it is recommended that an interface circuit be used, so that the logic levels of the 400 are not loaded by the capacitance of the interconnecting cable, which should, in any case, be kept as short as possible.

Layout of the logic is not critical, the prototype having been constructed on Veroboard; it should be emphasized, however, that adequate decoupling must be used, as is appropriate for ttl or LS ttl. A 0·1μF capacitor per ic is more than adequate and may help reduce the effect of stray rf, and, for the same reason, the logic unit should be housed in a metal cabinet.

It is recommended that a good quality timing component be used with IC5 to prevent the writing position drifting. The capacitors should be polyester rather than ceramic, and the variable resistor can be a multi-turn cermet trimmer.

Modifications to the 400

Modifications to the 400 are quite minimal. Only one connection has to be broken, which can easily be done by removing U28 from its socket and bending up pin 3 (wrongly labelled pin 13 on the Robot diagram) [1]. A 1kΩ pull-up resistor can now be placed on top of the ic and connected between pins 3 and 14, with pin 3 becoming the $\overline{\text{WRITE}}$ input. The other connections required are as follows; IFHB from pin 2 U28, v from pin 4 U28, and $\overline{\text{CLOCK}}$ from pin 1 U59. Note: all U numbers refer to the Robot 400 schematic diagram.

If the interface circuit is used, it may be constructed on Veroboard and housed within the 400.

Alignment

Alignment is quite simple, only two controls being involved. First, set RV1 to maximum (+12V on pin 3, IC1) and RV2 to mid-track. The pen should now be held in front of the monitor screen with the brightness set fairly high; reducing the setting of RV1 should cause the pen to write. Reducing the monitor brightness and reducing the setting of RV1 will enable maximum sensitivity of the pen to be obtained. But note that reducing the setting of RV1 too far will cause the pen to stop writing; the correct setting for RV1 is just backed off from this point. The final adjustment required is to set RV2 so that the writing on the screen appears under the pen.

If the pen fails to work, the first thing to do is to carefully check the circuit for any wiring errors, as fault finding on this circuit will require the use of a good double-beam oscilloscope, preferably with a delayed time base. As the circuit does not involve any critical adjustments it should work first time.

Using the pen

In practice, use of the light pen is quite simple, providing the following procedure is followed. The first step is to set the background upon which writing is to be performed. Second, the shade of the writing must be set to give the desired contrast with the background. Finally, the MEMORY INPUT controls on the Robot 400 should be set to the CAMERA and HOLD modes.

Before writing on the screen it is important that the contrast and brightness of the monitor be set correctly to obtain writing on the particular background chosen. In general it will be found that the lowest contrast setting at which the writing can easily be seen will give the best results. This is especially true when putting black writing on a white background, in fact it

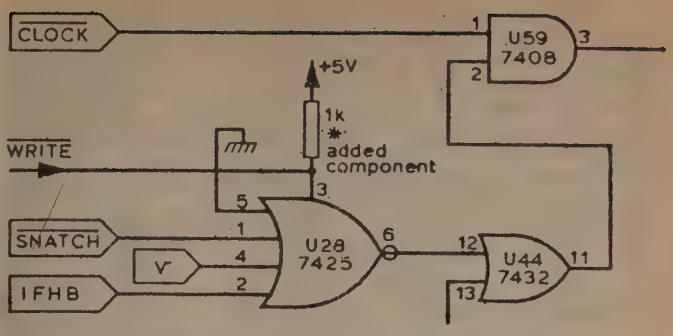


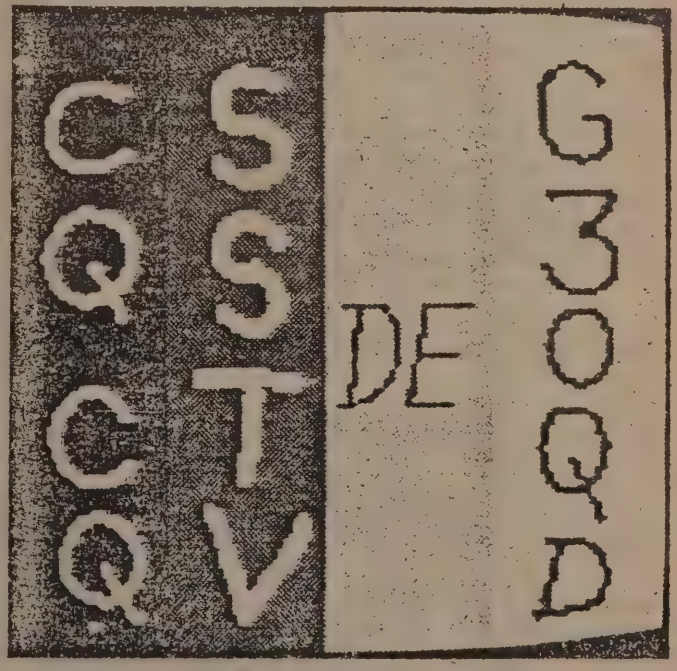
Fig 4. Modifications to Robot 400

may be found more convenient to use the video invert facility on the Robot 400 when this is required. It is of course necessary to have the monitor brightness set so that there is adequate brightness for the photo transistor to detect at all parts of the screen to be written on. As it is operationally inconvenient to change the contrast and brightness controls of the monitor between using the light pen and receiving sstv, it is quite possible to use a second monitor in parallel, with its controls adjusted to suit the light pen.

It will be found necessary to write slowly on the screen, rather like writing with chalk on a blackboard, otherwise the vertical lines will become broken. The reason for this is fundamental, and due to the 20ms screen refresh rate.

Setting the background

The background may be set in a number of ways, the simplest of which is either a plain black or white. This is achieved by setting the SNATCH CONTRAST to zero and then snatching a frame with the SNATCH BRIGHTNESS, at zero for a black background or at maximum for white. It is not necessary to have a camera or other fast-scan source connected during this operation. However, if a grey background is required it will be necessary



Different writing thicknesses on grey scale background

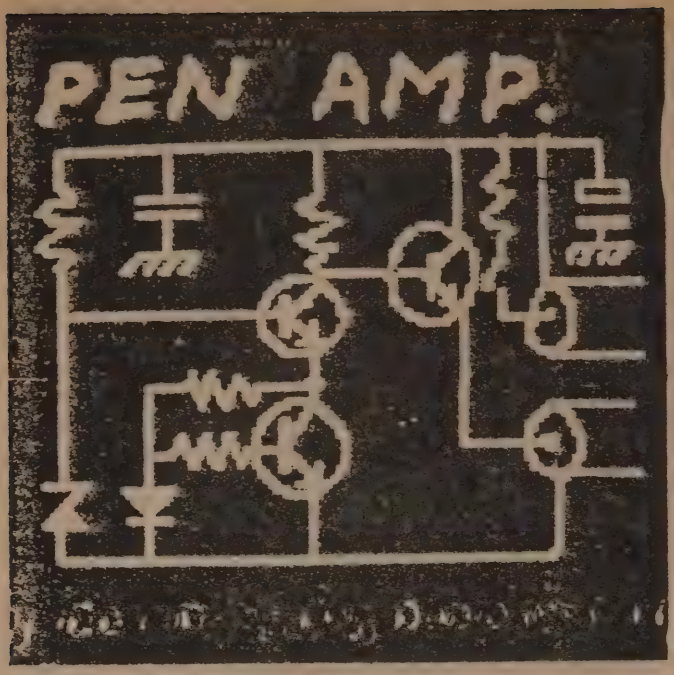


Diagram drawn using "thin" writing position

Writing on a picture background

to guess the setting of the brightness control before pushing the snatch button. But with a camera or other source of fast-scan video connected, it is possible to set the exact grey shade required by switching to DISPLAY CAMERA mode.

A further readily-available background is the internally generated grey scale in the Robot 400; it is possible to snatch a frame of grey scale and then write down the stripes.

Horizontal stripes may also, but not so conveniently, be achieved as follows. Turn the RECEIVED CONTRAST to zero, then, by adjusting the receive brightness while the converter scans down the screen, stripes of any height or shade may be produced. The HOLD switch must then be set to hold, to prevent the carefully-prepared background from being erased.

During the above operation the controls on the 400 are set as normal for receiving sstv, except that it is desirable to disable the input signal by switching to TAPE or OTHER to prevent incoming sync pulses resetting the display.

It is also quite possible to write on a picture, which may be snatched from camera or other fast-scan video source or received as sstv over the air or from tape.

Setting the writing shade

The writing shade is set using the SNATCH BRIGHTNESS control with the SNATCH CONTRAST set to zero. The control should be set to give adequate contrast between the writing and the background. Normally white (control at maximum) or black (control at maximum) are used to give maximum contrast, but grey could be used if desired. In fact the writing contrast can be reduced to zero so that the pen writes at the same shade as the background and the pen then becomes an eraser.

Selecting the writing thickness

Of the three writing thicknesses available, the "medium" position is most suitable for general purpose use, the "thin" position can be used to advantage for drawing circuits etc on the screen, while the "thick" position can be useful in getting over essential information, such as callsigns, under poor conditions.

The off-screen photographs show some of the possible ways of using the light pen, other possibilities are left to the ingenuity of the user. It should be noted that the photographs were taken with the image processor [2] switched on; although not essential for operation of the light pen it is considered a worthwhile addition to the 400.

A further consideration is the type of monitor to be used with the pen. If the monitor has a protective glass plate in front of screen, this may have to be removed to enable the pen to be placed close enough to the screen. The pen has been used with both 9in and 12in monitors with good results, but it will be found easier to draw straight lines on the larger screen due to the 128 × 128 pixel matrix being larger. If too large a screen is used it may be impossible to obtain thick writing, unless the pen is modified to increase the area of view of the photo transistor.

Conclusions

Although it is the author's opinion that sstv should be used primarily for picture transmission, and that rtty is better suited for transmitting written information, the light pen described herein represents a simple alternative to the impersonal captions generated by an sstv keyboard.

Several copies of a slightly earlier version of the light pen have been sent to interested sstvers, and as a result several amateurs in Finland are to be seen on 14MHz using this light pen design.

References

[1] Schematic diagram Model 400, drawing No 400 931B. Robot Research Inc.

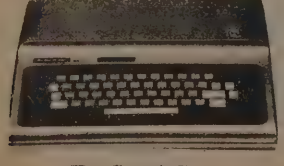
[2] "G3OQD image processor", *SSTV scene* July 1979, *Radio Communication* pp644-5. □

A5 MAGAZINE - K6AEP

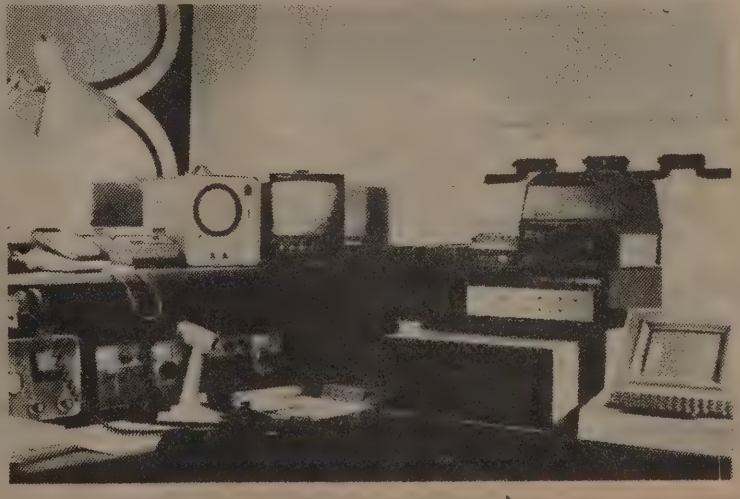
"SSTV'ER OF THE YEAR" 1981

K6AEP "SSTV'er of the Year"

Each November/December issue of A5 Magazine has been an SSTV Special edition issue. A5 Magazine announces the winner of 1981 "SSTV'ER OF THE YEAR" award; Clay Abrams, K6AEP of San Jose, California! Clay is a familiar operator on both 28.680 and 14.230 Mhz. SSTV operating frequencies & has been dazzling us all with his expertise in blending the new world of microprocessors with Amateur Radio. Clay, in 1980, was demonstrating his Southwest Technical Products 6800 computer on SSTV showing the unbelievable flexibility the system had for taking standard SSTV pictures, dividing them into quadrants, turning them around and blowing them up into zoom positions. His "Histogram" analized the grey levels within the received picture and showed in SSTV form what the picture detailed. Clays' determination to give the SSTV operator a better and more economical way of receiving and transmitting SSTV kept him creating more and more programs for the com puters. The big "break" came in the fall of 1980 when Radio Shack (Tandy Co.) announced that it had upgraded its' personal computer line to a new based 6809 8-bit processor called RS-80C COLOR Computer. Now a commercial, well known, firm had broken the market with a better, more flexible system that Clay was familiar with--and could do something with. And do something with--he has! Quite a number of SSTV'ers around the globe are now operating the TRS-80C & lay Abrams "software". Clay continues to add on new features of his programs just about every ouple months. To date, Clay has programs for RTTY & CW, and SSTV keyboard transmit and a new ogram for SSTV receive in either 4 shade grey-levels or16 shade grey-levels depending on the memy capability of the computer itself. (A5 Magazine article to follow). The photo of Clay was taken uring an award ceremony a couple years ago when he won $500 worth of microcomputing equipment. Clay got going on SSTV back in 1977 with interest in computers when software or affordable gear as not readily available. Clay built up his own SWTP-6800 system and started experimenting with litional plug in cards and programs relating to Amateur Radio. The prices that some Rtty and SSTV anufacturers were charging the Amateur for simple logic circuits was unacceptable to Clay--and he t out to provide Amateurs' worldwide with a more economical and flexible system. This years' A5 agazine "SSTV'ER OF THE YEAR" award was very difficult to choose. Last years' receipiant Dave uthrie, 5NØDOG led all contenders with his gentlemanly operating skills. 1981's winner was a very fficult choice as we had some very good operators to choose from, a couple COLOR SSTV'ers that ave opened the door to all SSTV'ers for COLOR transmissions and an operator in Germany who has signed some fantastic converters for the arket. Clay, K6AEP was chosen by A5 agazine for his unselfish determination "help" his fellow SSTV'ers, and his ability to take his ideas from his head and put s work to practical use in affordable gear. Our congratulations to CLAY ABRAMS, 6AEP, 1758 Comstock Lane, San Jose, CA. 5124 as A5 MAGAZINE'S "SSTV'ER OF THE EAR FOR 1981!!!



TRS-80C



K6AEP San Jose "Shack"

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A5 Magazine Computer Contributing Editor

Slow-Scan in Bits and Bytes

— microprocessors and plug-in cards can give you flexibility on SSTV

When starting on my first slow-scan television (SSTV) project back in 1977, little help was available. To initiate even the most primitive functions required a significant effort. The microprocessor industry has advanced far in these past few years, however, to a point where hardware is available off the shelf for many applications. A home experimenter can create an entire computer system in a few hours simply by selecting cards and plugging them into a common bus where the bus is just a number of common connectors mounted on a PC board.

The concept of picking and chosing components is not a new one. This technique is standard in hi-fi systems. One can buy speakers from one manufacturer, a turntable from another, and an amplifier from a third. Why not apply this technique to computers?

You may ask, how do all of this apply to amateur radio SSTV? In this article I will discuss two components, or cards, which can plug into a common bus to create a microprocessor based SSTV system. A system of this type, unlike its hardware-only counterpart, has great flexibility. If your ham shack is as cramped as mine—see Photo A—you don't have room to install a box which is devoted only to SSTV. With these cards and a general purpose microcomputer system, an SSTV system with unbelievable flexibility and features can be created. The system can be used for other amateur radio modes, i.e., RTTY or CW, by simple program changes.

Before plowing ahead into pages of technical details, I think a short

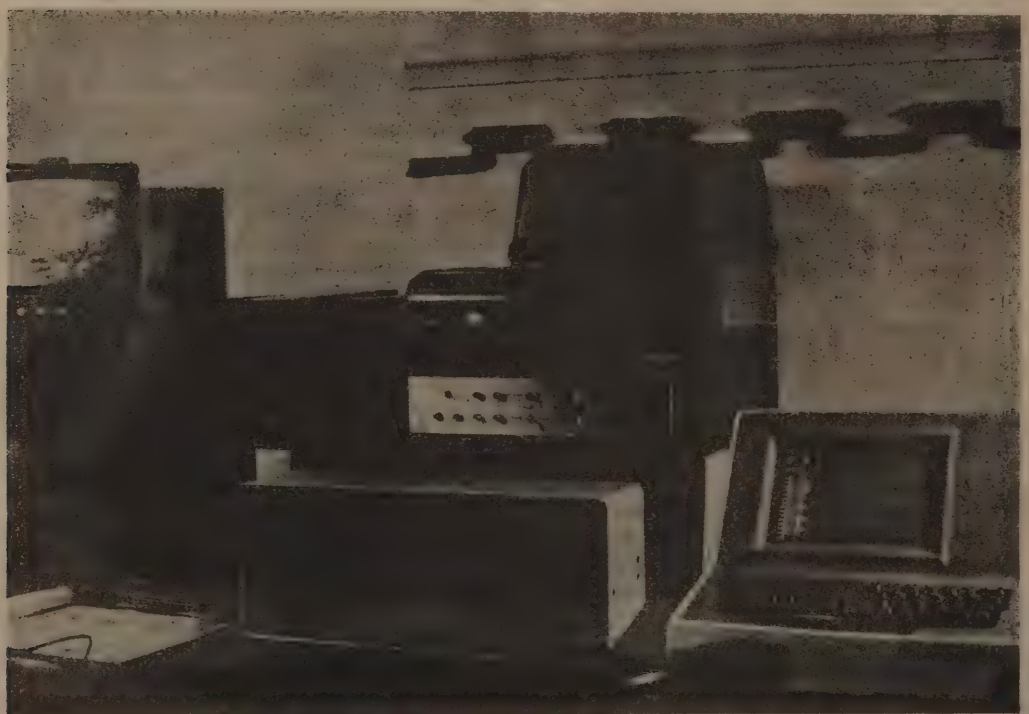


Photo A. Computer installation of K6AEP.

eview of SSTV is appro-riate.

STV Description

SSTV is a scheme to ransmit and receive tele-ision pictures over ama-eur radio. The pictures ave reduced resolution nd are slow, hence the ame.

SSTV has a bandwidth ow enough to be compati-le with all amateur trans-nitters. The pictures are eceived and generated rom audio tones which are aried proportionately to he television rates. Typical ones are 1500 Hz for black nd 2300 Hz for white, with n between tones for vari-ous gray levels. To synchro-nize these video frequen-cies, a tone (1200 Hz) must e provided. All that has to e done to interface SSTV o the amateur equipment s to plug the transmitted SSTV into the microphone ack and the received SSTV directly into the micropro-cessor.

The Hardware

To make a system like this possible requires the four components shown in Fig. 1. Each component is a product of modern technol-ogy and is difficult for the non-computer expert to understand. However, if you treat each component simply as a black box and don't worry about how it functions, interfacing can be easy.

I'll discuss each of the components individually, starting with the two fast-scan interfaces.

1. *The Digisector Television Camera Interface.* The Digisector is an interface card for any standard (NTSC) or non-standard (industrial) television camera. The card is available from a firm in southern California called Microworks.[1] The card is available in three configurations, allowing attachment to a number of microprocessor systems, i.e., IEEE-696 (S-100), SS-50, and Apple. All cards function in a similar manner, as follows: The cards section the TV picture up into a maximum of 256 X and Y coordinates. You can address up to 65k picture locations with the card. The card will respond to the programmed coordinates with a 6-bit (64) gray-level pixel. The card responds very quickly, within 12 microseconds maximum.

The card accomplishes this trick by using a fast sample-and-hold and a medium-speed successive approximation analog-to-digital converter. You program where you want the card to digitize a pixel by loading the X and Y coordinates in their respective ports. The port is connected to two 8-bit comparators which are in turn connected to two counters. The counters are driven by pulses derived from the camera's vertical and horizontal sync. When the programmed count equals the counter, you have a match and the video signal is digitized.

The Microworks people did this using 23 ICs for the DS-68 (SS-50) and 25 ICs for the DS-80 (IEEE-696). They did a great job with the DS-68 in cramming so much circuitry onto a small SS-50 I/O card (Photo B). The card has only two adjustments: brightness and width. The brightness is used to compensate for the camera room lighting. The width is used to adjust the maximum right-hand X coordinate location of picture digitization.

2. *The Fast-Scan TV Display Interface.* This board is one of the most recent additions to the Microworks product line. The board can be used for three unique functions:

- Fast-scan gray-level display interface. (Display has a density of 128 pixels on 128 lines with 16 gray levels.)
- Fast-scan high-resolution graphics display interface. (Display has a density of 256 pixels on 256 lines with two gray levels.)
- Static RAM board, 8K.

Since the purpose of this article is SSTV, the fast-scan gray-level display mode is of the most interest. To display a gray-level picture, all that has to be done is to address the card for any 8K free RAM area and connect the TV display to the appropriate output. The board has two composite video outputs, one for high-resolution graphics, the other for the gray-level display. I found it convenient to mount a switch on the top of the card to switch be-

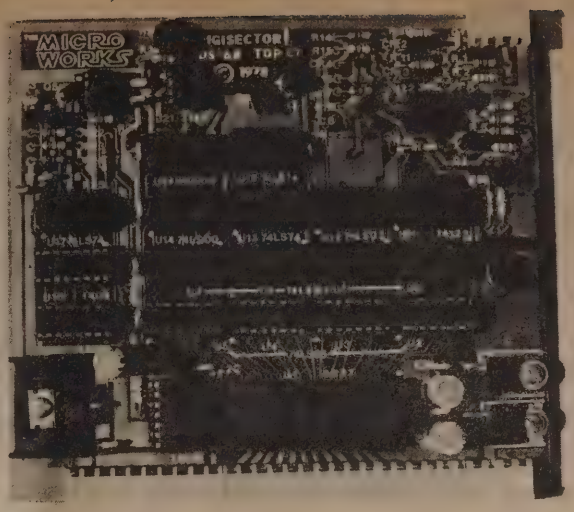


Photo B. Digisector card.

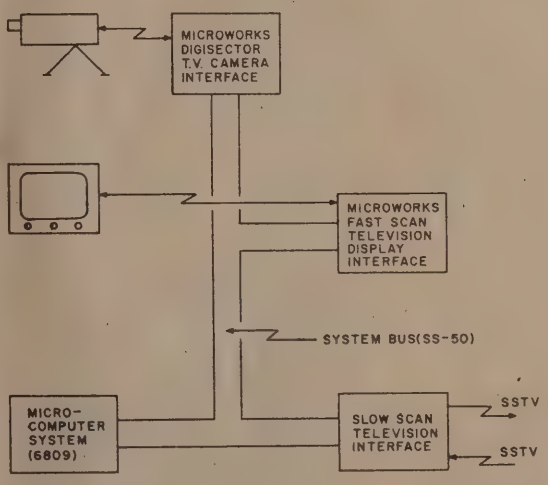


Fig. 1. Block diagram of a microprocessor-based SSTV system.

Gray-Level RAM Formatting

	MSB				LSB			
Byte in RAM	X	X	X	X	X	X	X	X
	pixel 1				pixel 2			

High-Resolution Graphics RAM Formatting

	MSB							LSB
Byte in RAM	X	X	X	X	X	X	X	X
Pixel #	1	2	3	4	5	6	7	8

Fig. 2.

Program Listing.

```
                        *
                        * SSTV PROGRAM FOR THE RECEPTION
                        * DISPLAYING AND TRANSMISSION
                        * OF AMATEUR RADIO SSTV PICTURES.
                        * THE PROGRAM IS WRITTEN IN 6809
                        * ASSEMBLER LANGUAGE AND IS WRITTEN
                        * TO RUN ON EITHER A SWTPC 6809 SYSTEM
                        * OR THE RADIO SHACK COLOR COMPUTER.
                        * THREE INTERFACE CARDS ARE REQUIRED
                        * FOR OPERATION OF THIS PROGRAM.
                        * TWO OF THE CARDS ARE AVAILABLE FROM
                        * THE MICROWORKS, THE THIRD WAS
                        * PUBLISHED IN "73 MAGAZINE" NOVEMBER
                        * 1978.
                        * PROGRAM WRITTEN BY: CLAYTON W. ABRAMS
                        * 1758 COMSTOCK LANE,SAN JOSE, CALIF
                        * 95124 (AMATEUR CALL K6AFP)
                        * DECEMBER 15,1980
                        *
                                OPT PAG
                                NAM SSTV71 FOR MICROWORKS CARDS .
                        *
                        * TEMPORARY LOCATIONS IN RAM
                        * RELATIVE TO USER STACK
                        * SYSTEM STACK IS PLACED
                        * BELOW USER STACK
                        *
                FFFF    RECVC   EQU -1          RECEIVE DELAY CONSTANT
                FFFD    LINE    EQU -3          NUMBER OF PICTURE LINES
                FFFB    RPIXC   EQU -5          RECEIVED PIXELS
                FFF9    PIXC    EQU -7          PIXELS IN A PICTURE
                FFF7    MASK    EQU -9          KEYBOARD ENTRY MASK
                FFF5    INDEX   EQU -11         INDEX STORAGE
                FFF3    RLINE   EQU -13         RECEIVED LINES
                FFF1    FAST    EQU -15         CAMERA BYTE STORAGE
                        *
                        * PROGRAM EQUATES FOR
                        * I/O ADDRESSES AND VIDEO
                        * CARD
                        *
                E000    PIADA   EQU $E000       BASE ADDRESS FOR DIGISECTOR
                E001    PIACA   EQU PIADA+1
                E002    PIADB   EQU PIADA+2
                E003    PIACB   EQU PIADA+3
                        *
                        * SSTV INTERFACE BOARD
                        *
                E010    PIA     EQU $E010       BASE ADDRESS FOR SSTV CARD
                        *
                        * FAST SCAN VIDEO BOARD
                        *
                8000    VIDBFG  EQU $8000       BEGINNING OF VIDEO CARD RAM
                9FFF    VIDEND  EQU $9FFF       END OF VIDEO CARD RAM
                        *
                        * ACIA CONTROL PORT
                        *
                E004    PIACTL  EQU $E004       ACIA FOR TERMINAL
                        *
1000                    ORG $1000
                        *
                        * MAIN LINE ROUTINE TO
                        * SELECT PROGRAM OPTIONS
                        *
1000 1F  43     BEGIN   TFR S,U         PLACE U STACK SAME AS SYSTEM
1002 32  E8 EC          LEAS -20,S      PLACE S BELOW USER STACK
1005 20  00             BRA START
                        *
                        ************************************
                        * PROGRAM CONSTANTS FOR
                        * DELAY ROUTINES AND LOCATIONS
                        * IN RAM,ASSUMING A 1MHZ CLOCK
                        ************************************
                        *
                        * FAST SCAN RECEIVE ROUTINES
                        *
1007 21         FRE60   FCB $21         60 HZ DELAY
1008 1A         FRE50   FCB $1A         50 HZ DELAY
                        *
                        * FAST SCAN SSTV XMIT DELAYS
                        *
1009 0044       FDELX   FDB $0044       TRANSMIT DELAY
100B 02C6       FHORX   FDB 710         HORIZONTAL SYNC PULSE (5 MSEC)
100D 1B8C       FVERX   FDB 7100        VERT SYNC (50 MSEC)
                        *
                        * MICROWORKS VIDEO
                        * CARD ADDRESSES
                        *
100F 8380       VIDEO   FDB $8380       SSTV RAM START ADDRESS
1011 84FD       VIDEO1  FDB $84FD       CAMERA RAM START ADDRESS
                        *
                        * BYTE TO TELL IF A RADIO
                        * SHACK OR SWTPC TYPE
                        * COMPUTER IS IN USE
                        * IF BYTE IS 0 (SWTPC) IF
                        * $FF THEN A RADIO SHACK
                        * COMPUTER IS IN USE
                        *
1013 00         RS      FCB 0           RADIO SHACK BYTE
                        *
                        ************************************
                        *
1014 30  8D 028D START  LEAX MENU,PCR PRINT MENU FOR OPTIONS
1018 8D  24             BSR OUT
101A 8D  3E             BSR INEEE       GET K/B RESPONSE
101C 81  46             CMPA #'F
101E 1027 0176          LBEQ FASTX      FAST SCAN XMIT ?
1022 81  52             CMPA #'R
1024 1027 0058          LBEQ RECFST     RECEIVE PICTURE ?
1028 81  43             CMPA #'C
102A 1027 01F4          LBEQ CAMER      TV CAMERA ?
102E 81  1B             CMPA #$1B
1030 27  06             BEQ ESC         ESCAPE TO FLEX 9
1032 81  C8             CMPA #$08
1034 27  05             BEQ RSBS        GOTO RADIO SHACK BASIC
1036 20  DC             BRA START
                        *
                        * KEYS TO EXIT PROGRAM
                        * ESC ESCAPES TO FLEX 9 DOS
                        * BS ESCAPES TO RADIO SHACK
                        * BASIC
                        *
1038 7E  CD03   ESC     JMP $CD03       FLEX 9 WARM START
1038 7E  A027   RSBS    JMP $A027       RADIO SHACK BASIC
                        *
                        * ROUTINES TO SUPPORT
                        * A SWTPC LIKE SYSTEM
                        * WITH A TERMINAL AND ACIA
                        * ON PORT 1 ($E004). ROUTINES
                        * ASSUME A 6850 ACIA IS USED.
                        *
103E 6D  8C D2  OUT     TST RS,PCR      IS BYTE A ZERO ?
1041 26  2A             BNE OUTRS       IF NOT BRANCH
1043 8D  05             BSR OUT1        OUTPUT A STRING
1045 81  04             CMPA #4
1047 26  F5             BNE OUT         LOOP IF NOT A 4
1049 39                 RTS
                        * OUTPUT SUBROUTINE
104A 34  04     OUT1    PSHS B
104C A6  80             LDA 0,X+        GET BYTE FROM RAM
104E F6  E004   OUT2    LDB PIACTL      TEST STATUS
1051 C5  02             BITB #2
1053 27  F9             BEQ OUT2        TRY AGAIN IF BUSY
1055 B7  E005           STA PIACTL+1    OUTPUT BYTE
1058 35  84             PULS PC,B
                * INPUT ROUTINE
```

```
105A 6D  8C B6  INEEE   TST RS,PCR
105D 26  1C             BNE INRS
105F B6  E004           LDA PIACTL      TEST FOR BUSY
1062 85  01             BITA #1
1064 27  F4             BEQ INEEE
1066 B6  E005           LDA PIACTL+1    GET K/B ENTRY
1069 34  04             PSHS B
1068 20  E1             BRA OUT2        ECHO BYTE
                        *
                        * ROUTINES WHICH ASSUME
                        * THAT A RADIO SHACK COLOR
                        * COMPUTER IS USED. PROGRAM
                        * USES CALLS FROM THE BASIC
                        * ROM (VERSION 1.01) ROUTINES
                        * ARE VECTORED THROUGH I/O
                        * VECTORS LOCATED AT THE BEGINNING
                        * OF THE BASIC ROM.
                        *
                        * OUTPUT A STRING
1060 8D  05     OUTRS   BSR OUTRS1      OUTPUT TILL $4
1062 81  04             CMPA #4
1071 26  FA             BNE OUTRS
1073 39                 RTS
                        * OUTPUT ROUTINE
1074 A6  80     OUTRS1  LDA 0,X+        GET BYTE FROM RAM
1076 AD  9F A002        JSR [$A002]     OUTPUT THROUGH BASIC
1079 39                 RTS
                        * INPUT A BYTE TO A
1078 AD  9F A000 INRS   JSR [$A000]     INPUT THROUGH BASIC
107F 4D                 TSTA            IS IT A ZERO ENTRY ?
1080 27  F9             BEQ INRS        KEEP LOOKING UNTIL NOT ZERO
1082 39                 RTS
                        *
                        * RECEIVE FAST SCAN
                        *
1083 A6  8C 81  RECFST  LDA FRE60,PCR GET DELAY CONSTANT
1086 A7  5F             STA RECVC,U     SAVE IT IN RAM
1088 86  40             LDA #64         128 LINES/PICTURE
108A A7  5D             STA LINE,U
108C 86  0F             LDA #111        111 PIXELS/LINE
108E A7  5B             STA RPIXC,U     SAVE IN RAM
1090 A7  57             STA MASK,U      MAKE MASK NOT ZERO
1092 8D  28     RFST1   BSR FPIXR       RECEIVE PICTURE
1094 6D  57             TST MASK,U      IS MASK ZERO ?
1096 27  02             BEQ RFST2       IF NOT GET ANOTHER PICTURE
1098 20  F8             BRA RFST1
                        *
                        * LOCK FOR FAST SCAN OPTION
                        *
109A B6  E005   RFST2   LDA PIACTL+1    LOCK FOR A K/B ENTRY
109D 81  35             CMPA #'5
109F 27  07             BEQ RFST3       50 HZ RECEIVE
10A1 81  36             CMPA #'6
10A3 27  0D             BEQ RFST4       60 HZ RECEIVE
10A5 16  FF6C           LBRA START
                        *
                        * 50 HZ VIDEO
                        *
10A8 A6  8D FF5C RFST3  LDA FRE50,PCR GET DELAY CONSTANT
10AC A7  5F             STA RECVC,U
10AE A7  57             STA MASK,U      RESET MASK
10B0 20  E0             BRA RFST1
                        *
                        * 60 HZ VIDEO
                        *
10B2 A6  8D FF51 RFST4  LDA FRE60,PCR DELAY CONSTANT
10B6 A7  5F             STA RECVC,U
10B8 A7  57             STA MASK,U
10BA 20  D6             BRA RFST1
                        *
                        * RECEIVE FAST SCAN PIX
                        *
10BC 17  00CA   FPIXR   LBSR INITC      INITALIZE PIA
10BF 6F  5D             CLR LINE,U      CLEAR COUNTERS
10C1 6F  59             CLR PIXC,U
10C3 8D  38             BSR FVERT       WAIT FOR A VERT SYNC PULSE
10C5 AE  8D FF45        LDX VIDEO,PCR   GET RAM LOACTION TO STORE PIX
10C9 AF  55             STX INDEX,U     SAVE IT IN INDEX
10CB 86  C8             LDA #8          DELAY FOR FIRST PIXEL
10CD 17  0098           LBSR DEL3
10D0 8D  78     FPIXR1  BSR STORE       FORMAT BYTES AND SAVE IN RAM
10D2 30  88 40          LEAX 064,X      SET X TO NEXT PIXEL
10D5 6C  59             INC PIXC,U      ADD 1 TO COUNTER
10D7 A6  59             LDA PIXC,U
10D9 A1  58             CMPA RPIXC,U    IS IT THE LAST ?
10DB 27  07             BEQ FPIXR2      BRANCH IF LAST
10DD A6  5F             LDA RECVC,U     DELAY FOR NEXT PIXEL
10DF 17  0086           LBSR DEL3
10E2 20  EC             BRA FPIXR1
10E4 6F  59     FPIXR2  CLR PIXC,U      CLEAR PIXEL COUNTER
10E6 6C  5D             INC LINE,U      ADD ONE TO LINE COUNTER
10E8 A6  5D             LDA LINE,U
10EA AE  55             LDX INDEX,U     GET NEXT ADDRESS IN RAM
10EC 30  01             LEAX 1,X        ADD ONE TO IT
10EE AF  55             STX INDEX,U     SAVE IT FOR NEXT LINE
10F0 A1  53             CMPA RLINE,U    IS IT THE LAST LINE ?
10F2 27  08             BEQ FPIXR4      IF SO QUIT
10F4 8D  2C             BSR FHORIZ      WAIT FOR A HORIZ SYNC PULSE
10F6 6D  57             TST MASK,U
10F8 27  02             BEQ FPIXR4
10FA 20  D4             BRA FPIXR1
10FC 39         FPIXR4  RTS
                        *
                        * WAIT FOR VERT SYNC
                        * PULSE
                        *
10FD B6  E012   FVERT   LDA PIA+2       LOOK FOR PULSE
1100 48                 ASLA            IS A PULSE PRESENT
1101 24  FA             BCC FVERT       IF NOT KEEP LOOKING
1103 6D  8D FF0C        TST RS,PCR      RADIO SHACK COMPUTER ?
1107 26  10             BNE FVERT3      IF YES BRANCH
1109 B6  E004   FVERT1  LDA PIACTL      LOOK FOR A K/B ENTRY
110C 44                 LSRA
110D 25  07             BCS FVERT2      IF AN ENTRY BRANCH
110F B6  E012   FVERT4  LDA PIA+2       LOOK FOR FALL TIME OF PULSE
1112 48                 ASLA
1113 25  FA             BCS FVERT4      BRANCH IF STILL PRESENT
1115 39                 RTS             PULSE IS NOW GONE
                        *
1116 6F  57     FVERT2  CLR MASK,U      CLEAR MASK K/B ENTRY
1118 39                 RTS
                        * TEST FOR RADIO SHACK
                        * COMPUTER
1119 AD  9F A000 FVERT3 JSR [$A000]     HAS A KEY BEEN STRUCK ?
111D 4D                 TSTA            IS A ZERO
111E 27  EF             BEQ FVERT4      A=ZERO, NO K/B ENTRY
1120 20  F4             BRA FVERT2
                        *
                        * WAIT FOR HORIZ
                        * SYNC OR KEYBOARD
                        *
1122 B6  E012   FHORIZ  LDA PIA+2       LOOK FOR HORIZ SYNC PULSE
1125 84  40             ANDA #$40
1127 27  F9             BEQ FHORIZ      NONE PRESENT,BRANCH
1129 B6  E012   FHOR1   LDA PIA+2       LOOK FOR PULSE END
112C 84  40             ANDA #$40
112E 26  F9             BNE FHOR1       BRANCH UNTIL NO PULSE
1130 6D  8D FEDF        TST RS,PCR
1134 26  0E             BNE FHOR4       BRANCH IF RADIO SHACK
1136 B6  F004           LDA PIACTL      LOOK FOR K/B ENTRY
1139 44                 LSRA
113A 25  05             BCS FHOR2       K/B HAS BEEN STRUCK
113C 86  20     FHOR3   LDA #32         DELAY FOR FIRST PIXEL
113E 8D  28             BSR DEL3
1140 39                 RTS
                        *
1141 6F  57     FHOR2   CLR MASK,U      SET K/B MASK
1143 39                 RTS
                        * TEST FOR RADIO SHACK COMPUTER
```

tween the two modes.

The board functions by allowing the on-board RAM to be refreshed at a video rate continuously. If you wish to read or write to RAM, the video-refresh process is halted for the period of reading or writing while the CPU gains control of the on-board RAM. This has a noticeable effect on your monitor as a small black line called a "sparkle." Otherwise, the picture is flawless, with a quality compatible with any commercial SSTV scan converter.

An experiment which I enjoy is running memory tests on the board. You can see how your memory test is performing. The patterns on the TV display are strik ing.

To understand how th pixels are formatted i memory, Fig. 2 can be use as a guideline.

You can see that if som how the picture was place

```
1144 AD  9F A000  FHOR4  JSR [$A000]    GET K/B ENTRY
1148 40          ISTA
1149 27  F1      BEQ FHOR3             NO ENTRY BRANCH
1148 20  F4      BRA FHOR2
                *
                * ROUTINE TO GET A SSTV BYTE
                * FROM THE INTERFACE CARD AND
                * PLACE IT INTO RAM
                *
114D 8D  10      STORE  BSR GETA       GET A BYTE FROM ADC
114F 48                 ASLA           FORMAT BYTE
1150 48                 ASLA
1151 84  F0             ANDA #$F0      MASK OUT GARBARGE
1153 34  02             PSHS A         SAVE IT ON STACK
1155 A6  5F             LDA RECVC,U    WAIT ONE PIXEL TIME
1157 8D  0F             BSR DEL3
1159 8D  11             BSR GETA       GET ANOTHER BYTE
115B 44                 LSRA
115C 44                 LSRA
115D 84  0F             ANDA #$0F      RIGHT JUSTIFY BYTE
115F 35  04             PULS B         GET OLD PIXEL BACK
1161 34  04  ABE0       ABA            ADD THE TWO TOGETHER
1165 A7  94             STA 0,X        SAVE THEM BOTH IN RAM
1167 39                 RTS
                *
                * GENERAL PURPOSE DELAY
                *
1168 4A  FD      DEL3   DECA           DELAY TILL A ZERO
                        BNE DEL3
1168 39                 RTS
                *
                * GET A PIXEL FROM ADC
                *
116C 34  10      GETA   PSHS X         SAVE X
116E 8E  E010           LDX #PIA       PUT X AT PIA ADDRESS
1171 86  3F             LDA #$3F
1173 A7  03             STA 3,X        PUT VALUE IN SAMPLE AND
1175 86  37             LDA #$37       HOLD
1177 A7  C3             STA 3,X
1179 86  38             LDA #$38       ISSUE A START ADC PULSE
117B A7  01             STA 1,X
117D 86  30             LDA #$30
117F A7  01             STA 1,X
1181 86  05             LDA #5         WAIT FOR CONVERSION
1183 8D  E3             BSR DEL3       MAY VARY WITH ADC
1185 A6  02             LDA 2,X
1187 35  90             PULS X,PC      GRAY LEVEL IS NOW IN A
                *
                * ROUTINE TO INITALIZE
                * SSTV PIA
                *
1189 8E  E010   INITC   LDX #PIA       PUT ADDRESS IN X
118C CC  FF30           LDD #$FF3B
118F ED  84             STD 0,X        MAKE A AN OUTPUT,SET UP CTL
1191 6F  02             CLR 2,X        MAKE B AN INPUT
1193 86  37             LDA #$37
1195 A7  03             STA 3,X        SET UP B CTL REGISTER
1197 39                 RTS
                *
                * FAST SCAN XMIT PIX
                * ON SSTV
                *
1198 30  8D 0189 FASTX  LEAX MENU1,PCR FAST SCAN XMIT MENU
119C 17  FE9F           LBSR OUT       PRINT IT
119F 17  FEB8           LBSR INEEE     GET K/B ENTRY
11A2 84  0F             ANDA #$0F      CONVERT TO HEX
11A4 34  02     FASTX1  PSHS A         SAVE IT ON STACK
11A6 8D  28             BSR FTRAN      XMIT PICTURE
11A8 35  02             PULS A
11AA 4A                 DECA           DECREMENT COUNT
11AB 26  F7             BNE FASIX1     BRANCH IF NOT LAST XMIT
11AD 16  FE64           LBRA START     GO BACK TO MAIN LINE
                *
                * XMIT SSTV PIX
                * SUBROUTINE
                *
11B0 86  69     FTRAN  LDA #105       XMIT 105 PIXELS/LINE
11B2 A7  50             STA LINE,U
11B4 86  40             LDA #64        XMIT 128 LINES
11B6 A7  59             STA PIXC,U
11B8 AE  8D FE53        LDX VIDEO,PCR  SET X TO RAM POINTER
11BC AF  55             STX INDEX,U
11BE 8D  0E     FTRAN1  BSR FTRAN3     XMIT ONE PICTURE LINE
11C0 8D  0C             BSR FTRAN3     XMIT SAME LINE AGAIN
11C2 AE  55             LDX INDEX,U    SET UP FOR NEXT PICTURE LINE
11C4 30  01             LEAX 1,X
11C6 AF  55             STX INDEX,U    SAVE NEW LINE LOACTION
11C8 6A  59             DEC PIXC,U
11CA 27  29             BEQ FTRAN2     LAST XMIT LINE ?
11CC 20  F0             BRA FTRAN1     IF NOT DO IT AGAIN
                *
11CE 34  10     FTRAN3 PSHS X         SAVE X
11D0 A6  84     FTRAN4 LDA 0,X        GET BYTE FROM RAM
11D2 1F  89             TFR A,B        SAVE IT IN B
11D4 84  F0             ANDA #$F0      MASK OUT LOW NIBBLE
11D6 30  88 40          LEAX 64,X      SET X UP FOR NEXT PIXEL
11D9 8A  01             ORA #$01       TURN OFF SYNC PULSE
11DB B7  E010           STA PIA        XMIT GRAY LEVEL
11DE 58                 ASLB           SET UP FOR NEXT NIBBLE
11DF 58                 ASLB           BY SHIFTING LEFT 4X
11E0 58                 ASLB
11E1 58                 ASLB
11E2 CA  01             ORB #$01       TURN OFF SYNC
11E4 8D  12             BSR FDEL       DELAY ONE PIXEL TIME
11E6 F7  E010           STB PIA        XMIT GRAY LEVEL
11E9 6A  5D             DEC LINE,U     DECREMENT PIXEL CNTR
11EB 26  E3             BNE FTRAN4     IF NOT LAST BRANCH
11ED 8D  13             BSR FXHOR      SEND A HORIZONTAL SYNC PULSE
11EF 86  69             LDA #105       RESTORE PIXEL COUNTER
11F1 A7  50             STA LINE,U
11F3 35  90             PULS X,PC      GO BACK TO MAIN LINE
11F5 8D  18     FTRAN2 BSR FXVER      XMIT A VERTICAL SYNC PULSE
11F7 39                 RTS            PICTURE COMPLETED
                *
                *
                * FAST SCAN PIXEL XMIT
                * DELAY (7 MACHINE CYCLES/LOOP)
                *
11F8 10AE 8D FE0C FDEL   LDY FDELX,PCR GET PIXEL DELAY TIME
11FD 31  3F       FDEL1  LEAY -1,Y      DECREMENT BY ONE
11FF 26  FC              BNE FDEL1      DO IT AGAIN IF NOT ZERO
1201 39                  RTS
                *
                * HORIZONTAL SYNC.( 5 MILLI SECONDS)
                *
1202 7F  E010   FXHOR  CLR PIA         SEND A SYNC PULSE
1205 10AE 8D FE01      LDY FHORX,PCR  GET HORIZONTAL SYNC
120A 31  3F     FXHOR1 LEAY -1,Y      COUNT DOWN TILL ZERO
120C 26  FC            BNE FXHOR1
120E 7C  E010          INC PIA        TURN OFF SYNC PULSE.
1211 39                RTS
                *
                * VERT SYNC. ( 50 MILLI SECONDS)
                *
1212 7F  E010   FXVER  CLR PIA         SEND SYNC (1200 HZ)
1215 10AE 8D FDF3      LDY FVERX,PCR  COUNT DOWN
1219 31  3F     FXVER1 LEAY -1,Y
121C 26  FC            BNE FXVER1
121E 7C  E010          INC PIA        TURN OFF SYNC (1500 HZ)
1221 39                RTS
                *
                * TV CAMERA PICTURE FROM DIGISECTOR
                * INTERFACE CARD
                *
1222 8D  6E     CAMER  BSR INITCA     INITALIZE PIA ON CARD
1224 8D  5F            BSR CLFST      MAKE RAM AREA TOTAL BLACK
1226 86  01            LDA #1         FIRST X COORDINATE
1228 C6  01            LDB #1         FIRST Y COORDINATE
122A AE  8D FDE3       LDX VIDEO1,PCR GET RAM AREA FOR PICTURE
122E 6F  51             CLR FAST,U    CLEAR TEMP STORAGE BYTE
1230 B7  E000   CAMER1  STA PIADA     PLACE X ADDRESS IN PIA
1233 F7  E002           STB PIADB     PLACE Y ADDRESS IN PIA
1236 34  02             PSHA          SAVE X ADDRESS
1238 86  FE             LDA #$FE      PIA MASK
123A 7D  E001   CAMER2  TST PIACA     IS PIA ZERO ?
123D 2A  F8             BPL CAMER2    IF NOT BRANCH
123F B7  E000           STA PIADA     RESET PIA
1242 B6  E000           LDA PIADA     GET PIXEL VALUE FROM CAMERA
1245 43                 COMA          MAKE IT COMPATABLE WITH PROG.
1246 48                 ASLA
1247 48                 ASLA          THROW AWAY TWO LSB OF PIXEL
1248 84  F0             ANDA #$F0     GET RID OF GARBARGE
124A A7  51             STA FAST,U    SAVE IT IN RAM FOR LATER USE
124C 35  02             PULA          GET OLD X ADDRESS IN PICTURE
124E CB  02             ADDB #2       LOOK AT LINE AFTER NEXT
1250 C1  FB             CMPB #251     IS IT THE LAST LINE ?
1252 27  24             BEQ CAMER4    IF SO GIVE UP
1254 B7  E000           STA PIADA     SET X ADDRESS FOR NEXT PIXEL
1257 F7  E002           STB PIADB     SET UP Y ADDRESS
125A 34  02             PSHA          SAVE A ADDRESS
125C 86  FF             LDA #$FF
125E 7D  E001   CAMER3  TST PIACA
1261 2A  F8             BPL CAMER3
1263 B7  E000           STA PIADA
1266 B6  E000           LDA PIADA     GET THE PIXEL FROM THE CAMERA
1269 43                 COMA          FORMAT THE PIXEL
126A 47                 ASRA
126B 47                 ASRA
126C 84  0F             ANDA #$0F
126E AA  51             ORA FAST,U    ADD BOTH NIBBLES TOGETHER
1270 A7  80             STA 0,X+      STORE THE WHOLE MESS IN MEMORY
1272 35  02             PULA          GET X ADDRESS BACK
1274 CB  02             ADDB #2       LOOK FOR LINE AFTER NEXT
1276 20  88             BRA CAMER1    DO IT AGAIN
                * NEW X COORDINATE
                * ADD 3 FOR ASPECT
                * RATIO ON FAST SCAN
1278 C6  01     CAMER4 LDB #1         SET UP Y COORDINATE
127A 30  02            LEAX 2,X       ADD 2 TO THE RAM ADDRESS
127C 8B  03            ADDA #3        CAN BE CHANGED TO 2 (ASPECT)
127E 81  FD            CMPA #253      LAST A ADDRESS ?
1280 26  AF            BNE CAMER1
1282 16  FD8F         LBRA START     PICTURE IS IN RAM
                *
                * CLEAN OUT FAST SCAN
                * RAM AREA FOR NEW
                * PICTURE
                *
1285 108E 8000  CLFST  LDY #VIDBFG    GET RAM BEGINNING ADDRESS
1289 6F  A0     CLFST1 CLR 0,Y+       MAKE IT BLACK (0)
128B 10BC 9FFF         CMPY #VIDEND   IS IT THE LAST ADDRESS ?
128F 26  F8            BNE CLFST1     IF NOT DO IT AGAIN
1291 39                RTS
                *
                * INITALIZE CAMERA INTERFACE
                *
1292 7F  E001   INITCA CLR PIACA      SET UP X COORDINATE
1295 7F  E003          CLR PIACB      SET UP Y COORDINATE
1298 8E  FF04          LDX #$FF04
129B 8F  E000          STX PIADA
129E 8E  FE2C          LDX #$FF2C
12A1 8F  E002          STX PIADB
12A4 39                RTS
                *
                * MENUS  TO PROMPT OPERATOR FOR VARIOUS ACTION
                *
12A5 0A0D       MENU   FDB $0A0D
                       FCC /FAST SCAN SSTV PROGRAM (K6AEP)/
                       FDB $0A0D
                       FCC /R=RECEIVE FAST SCAN/
                       FDB $0A0D
                       FCC /D=RECEIVE FAST SCAN/
                       FDB $0A0D
                       FCC /DURING RECEIVE 5=50HZ 6=60HZ/
                       FDB $0D0A
                       FCC /F=XMIT FAST SCAN PICTURE/
                       FDB $0A0D
                       FCC /C=CAMERA INPUT/
                       FDB $0A0D
                       FCB 4
                *
1325 0A0D       MENU1  FDB $0A0D
                       FCC /TRANSMIT LOOPS 1 TO 9/
                       FDB $0A0D
                       FCB $4
                       END BEGIN
0 ERROR(S) DETECTED

SYMBOL TABLE:

BEGIN  1000   CAMER  1222   CAMER1 1230
CAMER2 123A   CAMER3 125E   CAMER4 1278
CLFST  1285   CLFST1 1289   DEL3   1168
ESC    1038   FAST   FFF1   FASTX  1198
FASTX1 11A4   FDEL   11F8   FDEL1  11FD
FDELX  1009   FHOR1  1129   FHOR2  1141
FHOR3  113C   FHOR4  1144   FHORIZ 1122
FHORX  1008   FPIXR  108C   FPIXR1 1000
FPIXR2 10E4   FPIXR4 10FC   FRES0  1008
FRES61 1007   FTRAN  1180   FTRAN1 11BE
FTRAN2 11F5   FTRAN3 11CE   FTRAN4 11D0
FVERT  10FD   FVERT1 1109   FVERT2 1116
FVERT3 1119   FVERT4 110F   FVERX  100D
FXHOR  1202   FXHOR1 120A   FXVER  1212
FXVER1 1214   GETA   116C   INDEX  FFF5
INEEE  105A   INITC  1189   INITCA 1292
INRS   107B   LINE   FFFD   MASK   FFF7
MENU   12A5   MENU1  1325   OUT    103E
OUT1   104A   OUT2   104E   OUTRS  1060
OUTRS1 1074   PIA    E010   PIACA  E001
PIACB  E003   PIACTL E004   PIADA  E000
PIADB  E002   PIXC   FFF9   RECEST 1083
RECVC  FFFF   RFST1  1092   RFST2  109A
FST3   1CA8   RFST4  10B2   RLINE  FFF3
RPIXC  FFF8   RS     1013   RSBS   103B
START  1014   STORE  1140   VIDREG 8000
VIDEND 9FFF   VIDEO  100F   VIDEO1 1011
```

memory, it would automatically be displayed. When you first look at the microworks board, you will be surprised at the small number of components (photo C). (This card is not a production model. I include the photo even though it is not representative of the final, professional-looking product.)

3. *The Slow-Scan Television Interface.* The SSTV interface card is the only non-commercially-available interface card that I use in the system. I still use the same card which was described in *73 Magazine*.[2] I would like to redesign the card some day and use more state-of-the-art components.

This card functions by taking a dc voltage proportional to the SSTV frequency, sampling the voltage with an analog-to-digital converter, and then placing the pixel into memory. The SSTV-output inter-

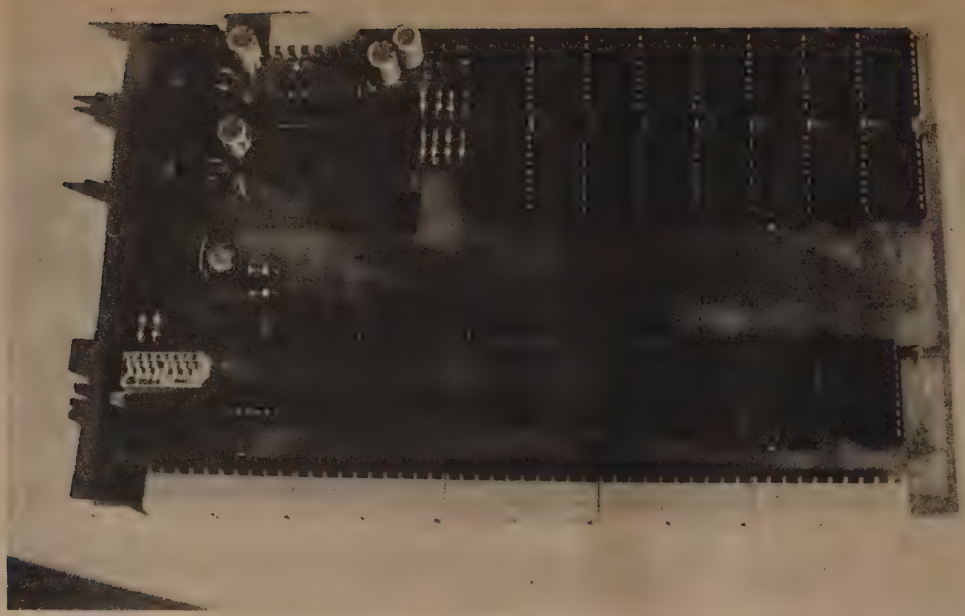


Photo C. Microworks fast-scan display card.

face takes the output from a digital-to-analog converter and feeds it into an SSTV modulator.

4. *The Microprocessor Component.* Remember to treat the microprocessor as just another system component. It can consist of a CPU card, a serial port, and a terminal. (The microprocessor also could be a more complex device such as a single-board computer.) The software which I will present later in this article can provide a software package which could be used for both system configurations.

The Microworks cards which I tested for this article are all SS-50 boards. Therefore, a motherboard must be acquired to plug in the cards if you wish to duplicate my work. The SS-50 bus has been used by a number of manufacturers since 1976. This computer bus structure is a good low-cost approach for system construction. Card costs in most cases tend to be lower than the IEEE-696 (S-100) or Apple bus. The manufacturers and numbers of cards available for this bus are large.

Another approach to interface the Microworks cards is to use a single-board-computer component which can attach to the SS-50 bus. An exciting product which will be very popular in the 1980s is the Radio Shack Color Computer. This computer was introduced in late 1980 and is the first commercial single-board computer which uses the Motorola 6809 processor. The 6809 is a very advanced processor which provides compute power which exceeds that of any of the existing 8-bit processors now available.

One of the interesting features of the color computer is the ease of interfacing. An adapter could be constructed between the side game cartridge connector and the SS-50 bus. Pins on the cartridge connector go directly to the 6809 CPU chip. All that has to be done is to add buffe on a small prototype car Run short wires to the SS-5 bus. You can then add th Microworks cards and yo have a working SST system.

I understand that manufacturer will soon o fer such a SS-50 adapte For those of you who wis to construct your ow adapter, Table 1 is provi ed. This gives a detaile description of each pin c the Radio Shack comput and the equivalent pin c the SS-50 bus.

You may ask if it is pos ble to adapt older Z8 based Radio Shack co puters to the SS-50 bus. It possible, but probab would take a significant fort. Since the color co puter is so cost-compe tive, it would be consid ably easier to obtain o than to spend the time a effort adapting an old generation Z80-based m chine.

The Software

To glue all the pieces gether, what is needed i software package. The p gram is a software packa which makes a comple SSTV system. It is written run on either an SW 6809-type system or a Rad Shack color computer. T package is less than 1K size and is written to position-independent. T feature is available o with the 6809 process This means that you c key the program into a place you like in your RA memory and it will run.

Since the program is w commented, I will not p vide flowcharts but w discuss the programming the Microworks cards some depth.

Systems Programming. the start of the program listing of program equa and constants. The progr assumes that the follow is the configuration of SS-50 cards:

Keyboard Selection	Program Function
F	Transmit the picture displayed on the Microworks display on SSTV. The program will ask for the number of loops desired.
R	Receive SSTV pictures and display them until a key is struck on the keyboard. If a key other than 5 or 6 is struck, the routine will end. If the key is a 5, 50-Hz SSTV will be received. If the key is a 6, 60-Hz SSTV will be received.
C	Capture a TV image from the Microworks Digisector Card. The image is displayed on the Microworks Fast-Scan Display card.
ESC	Jump to TSC FLEX 9 DOS warm start.
Backspace	Jump to Radio Shack BASIC cold start.

Fig. 3.

Program Constant	Function
VIDEO	Picture RAM start of upper right-hand corner
Pixels/line	Constant #111 loaded in RECFST
FRE60	60-Hz delay constant
FRE50	50-Hz delay constant

Fig. 4.

oto D. SSTV picture via amateur radio—live shot of 33APB on 10 meters, December 22, 1980.

TRS-80C Pin	Name	SS-50 Pin
1	−12 volts	(note 1)
2	+12 volts	(note 1)
3	Not HLT	45
4	NMI	35
5	Reset	42
6	E	39(phase 2)
7	Q	(note 2) 40 (VMA)
8	Rom init	none
9	+5	(note 1)
10	D0	1(note 3)
11	D1	2(note 3)
12	D2	3(note 3)
13	D3	4(note 3)
14	D4	5(note 3)
15	D5	6(note 3)
16	D6	7(note 3)
17	D7	8(note 3)
18	R/$\overline{W}$	41
19	A0	24
20	A1	23
21	A2	22
22	A3	21
23	A4	20
24	A5	19
25	A6	18
26	A7	17
27	A8	16
28	A9	15
29	A10	14
30	A11	13
31	A12	12
32	Select $C000-FF00	none
33	Gnd	25,26,27
34	Gnd	25,26,27
35	Audio input	none
36	Select $FF40-FF5F	none
37	A13	11
38	A14	10
39	A15	9
40	Disable BASIC ROM	none

lotes: 1. All SS-50 bus voltage must be developed on the bus.
2. VMA is developed by ANDing E and Q.
3. Data lines must be inverted on the SS-50 bus.

ble 1. Radio Shack Color Computer pinout vs. SS-50 bus.

Digisector base address	—$E000
Serial terminal	—$E004
Fast-scan display RAM	—$8000
SSTV interface	—$E010

The object code can be patched to accommodate any configuration you have. If you are using a Radio Shack color computer, the byte labeled RS should be changed to a $FF. With this change, all communications messages to and from program are routed through the BASIC ROM. One other change should be made with the Radio Shack computer. The base address of $8000 is in conflict with the extended BASIC ROM. If this is changed to $6000, the computer should be happy.

You may ask, how do I load this program into my Radio Shack computer? Well, Microworks can help out again. They can provide a monitor program called "CBUG" which will load from audio cassette tape or run in a single 2716 EPROM. The 2716 will plug directly in the Radio Shack computer in the extended BASIC ROM socket. You then will have a program in which you can use machine-language programming to load/save from the built-in audio cassette interface.

Eight bytes of program delays are placed as constants at the beginning of the program. These delays were empirically derived on my home-brew 6809 system with a 1-MHz cycle time. The Radio Shack computer operates at a 0.8949-MHz rate; therefore, all constants have to be increased slightly.

Eight program variables are defined with equates of minus numbers at the program start. These variables can be located anywhere in the memory space. Their location is defined by the location of the system stack when the SSTV program was executed. The system stack is transferred to the user stack and then decremented by 20. All references to these variables are made referenced to the user stack. This is a common programming technique which is used on advanced processors like the 6809 for program-position independence. The user stack is left at this location throughout program execution.

Main Line Software. After initialization of the user and system stacks, the START program is executed. This routine displays a menu on the terminal or TV set in the case of the Radio Shack computer. Five program options are possible, as shown in Fig. 3.

Receive Software. The receive software is very similar to two previously published articles.[2,3] Therefore, I will not discuss the basic principles in this article. One major difference between this program and the others is the formatting of pixels in memory. The memory in this case is the fast-scan display card.

A problem exists with all SSTV display systems—aspect ratio. SSTV has an aspect ratio of 1:1 where a normal TV is 4:3. Another factor which must be addressed is the type of TV which you are using. Some displays underscan the picture while others overscan slightly. In this software package, I chose to slightly overscan the SSTV picture on both the right- and left-hand borders. On the vertical, I decided to lose about 8 scan lines off the bottom of the picture. This appeared to be a satisfactory compromise. A typical SSTV picture received via ham radio appears in Photo D.

You may have to modify slightly the video-scan area to achieve optimum results. This is accomplished by modifying program constants in the areas listed in Fig. 4.

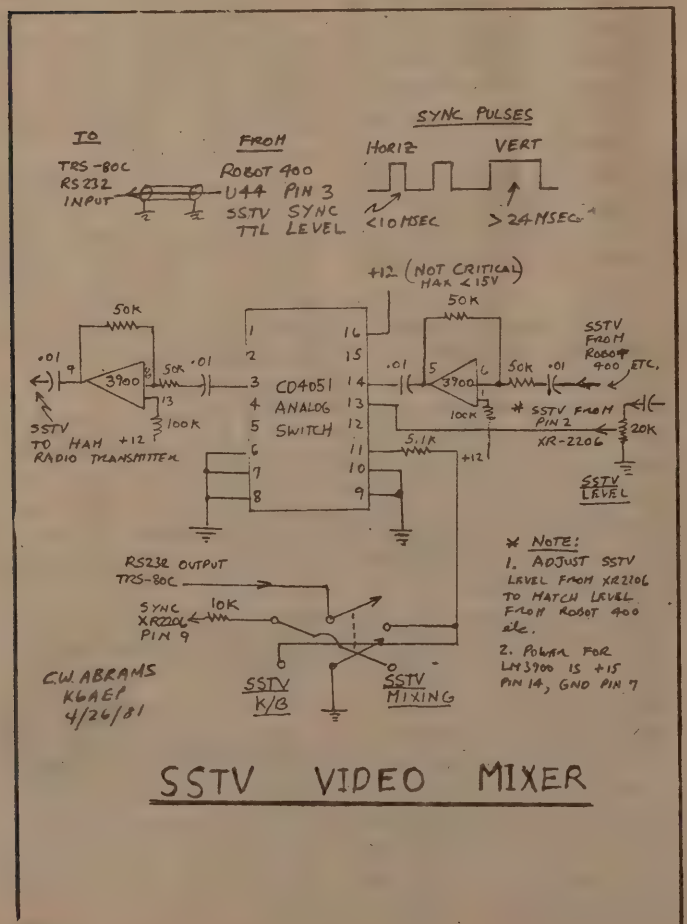
Photo E. TV camera picture displayed on the fast-scan card.

The only other difference in the receive routine from others published is the keyboard polling routine. During a vertical and horizontal sync pulse, the keyboard is polled to see if the keyboard has been struck. If so, the program is ended or a new program delay selected.

Transmit Software. The transmit SSTV picture software is similar to the same two referenced articles. The only major difference is in how the picture is accessed from memory. The picture in the conventional sense is rotated in memory by 90 degrees. This transmit routine accesses bytes from memory in a manner to rotate the picture and transmit it in a correct format.

Camera Software. The software to capture an SSTV picture from the Digisector card was a fun routine to write. The software is extemely time-dependent and functions as follows.

The CAMER routine grabs a picture from the TV camera in a format of 85 pixels/line on 128 lines with 16 gray levels. Why such a strange format? Well, the entire format is based upon a number of compromises of picture appearance, ease of programming, and aspect ratio. The Digisector card is great in that any type of format can be digitized from 256 pixels on 256 lines, with 64 gray levels. You can modify the format to any configuration you like by slight program changes.



Back to the Programming

What I tried to accomplish in this program was to:

- Display the entire camera frame on the fast-scan TV display.
- Make the aspect ratio as accurate as possible on the display.
- Place a black border around the picture to block out any unwanted garbage.

Photo E is a result of the programming. I might add that the lighting and the quality of my TV camera is not the greatest. In any case, you can get an idea of how it looks.

The Digisector is first initialized with the starting X and Y coordinate position in the picture. The program then waits for a response from the card. When the analog-to-digital conversion is completed, the gray level is loaded in the accumulator, formatted, and saved in a constant called FAST. This entire operation must be completed within 2 scan lines or 128 microseconds. The routine in this program takes about 56 cycles or 56 microseconc on my 1-MHz clock proce sor. The process is the repeated for the next pixe This time the pixel is ORe with FAST and saved in th video RAM.

The whole process take about 2 seconds. I was a li tle concerned with the gra time at first, but I found quite easy to sit still for seconds while the pictu was digitized. Therefor this condition did not pr sent a problem.

The formatting of th picture may vary depen ing on the TV camera, th width setting of the Di sector, and the TV displa If you wish to change th aspect ratio for 128 pixe line, change the $03 at loc tion $127D to $02. You m have to adjust the consta VIDEO1 to a lower value

Conclusions

The use of the Mic works cards to create SSTV system is an excelle choice. Unlike the ha ware-only SSTV scan c verters, the cards and so ware approach make a v satile and expandable s tem. Routines can be w ten to create a softwa only SSTV keyboard wh mixes graphics and p tures. Picture enhan ments can be programm to achieve many interest effects. You are limited ly by your programm skills and time.

I would like to thank E Lentz of Microworks for help in this project.

If you decide to drop a line to ask any spec questions, please inclu an SASE or IRCs for my r ly. ■

References

1. The Microworks, Inc., 194 Camino Real, Encinitas 92024; phone (714)-942-2400
2. "SSTV Meets SWTPC," *Magazine*, November and cember, 1978.
3. "Display SSTV Pictures Fast Scan TV," *Ham Radio*, 1979.

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ASCII, BAUDOT, AND THE RADIO AMATEUR

The 1970's have brought a revolution to amateur radio RTTY equipment and techniques, the latest being the addition of the ASCII computer code. Effective March 17, 1980, radio amateurs in the United States have been authorized by the FCC to use the American Standard Code for Information Interchange (ASCII) as well as the older "Baudot" code for RTTY communications. This paper discusses the differences between the two codes, provides some definitions for RTTY terms, and examines the various interfacing standards used with ASCII and Baudot terminals.

Construction of RTTY Codes

Mark and Space:

Newcomers to amateur radio RTTY soon discover a whole new set of terms, unique to RTTY equipment. Chief amoung these are the words *MARK* and *SPACE*. To be fair, these terms really are not unique to RTTY since they originated with land-line telegraph service before 1900. However, current usage associates *mark* and *space* with something RTTY'ers do to or with machines.

The terms *mark* and *space* date from early pen and moving paper strip recording of telegraph signals. The pen was solenoid operated so that the pen was lowered when the sending key was down, *marking* the moving strip; key-up time was represented by the blank *space* between *marks*. Of course, an operator familiar with the Morse code would then have to read the tape. One "tale" has it that the strip recording came first in telegraph operations and was used until the operators discovered that they could mentally decipher the code by listening to the rhythm of the mechanical sounder. Some strip-pen telegraph recorders are still to be found in use to this day.

Teleprinter machines also use solenoids (called *Selector Magnets*) that open and close in response to a signal current (*Loop Current*). Following the convention of telegraph recording, the current-on condition of the signal circuit, or *loop*, is called the *mark state* of the TTY signal and the current-off condition is called *space*. However, the TTY codes differ from telegraph codes in that variable length mark or space conditions (dot, dash, and spaces between them in telegraph codes) are not used to form the characters. Rather, the TTY codes use equal *time length* pulses which can be set to either mark or space. Letters, numbers, and symbols are encoded by different combinations of mark or space pulses.

Start, Data, Stop Pulses:

In a teleprinter machine, the normal "rest" condition of the selector magnet solenoids is with loop current *on*. Interruption of the loop current releases the selector magnet, allowing rotation of a cam in the machine. Transmission of a TTY character begins with a space pulse (current off), called the *start* pulse. The start pulse signals to the machine that reception of a character has begun. Immediately after the start pulse, a series of *data* pulses are transmitted with mark or space condition as indicated by the encoding for the desired character. The number of data pulses used to represent the letters, numbers, and symbols varies with the TTY code being used; "Baudot" code uses five data pulses, ASCII uses eight. Immediately after the last data pulse, a *stop* pulse is included which is always a mark pulse. The stop pulse therefore always occurs a fixed time after the start pulse (after 5 data pulses in Baudot and 8 in ASCII) and gives the machine a "rest time" to prepare for the beginning of the next character, maintaining receive machine synchronization with the transmitted signal. The time length of the start and each data pulse are the same and are often called the *unit pulse* or *select pulse* time. The stop pulse length varies from code to code and even with speeds within a code as will be explained later. In general, the minimum stop pulse length can be one to two times as long as the unit pulse time; stop pulses may be as long as desired since the machine is "at rest" until the next start pulse is received. This type of TTY code that uses start, data, and stop pulses in the construction of each character is called an *asynchronous* or *start-stop serial code*. Other codes also in commercial use include *synchronous serial codes*, in which start and stop pulses are not attached to the data pulses for each character and *parallel data codes* in which each data pulse is assigned a separate wire to and from the terminal device. Such codes are found in common use with computer and line printer devices. Radio amateurs in the United States are currently authorized to use either the Baudot or ASCII serial asynchronous TTY codes.

The Baudot TTY Code

One of the first data codes used with mechanical printing machines uses a total of five data pulses to represent the alphabet, numerals, and symbols. This code is commonly called the *Baudot* or *Murray* telegraph code after the work done by these two pioneers. Although commonly called the *Baudot* code in the United States, a similar code is usually called the *Murray* code in other parts of the world and is formally defined as the *International Telegraphic Alphabet No. 2 Baudot Code* in part 97.69 of the FCC Rules and Regulations. This standard defines the codes for letters, numerals, and the slant or fraction bar but allows variations in the choice of code combinations for punctuation. U.S. amateurs have generally adopted a version of the so-called "Military Standard" code arrangement for punctuation, due largely to the ready availability of military surplus machines in the post 1945 years. Amateurs in other countries (particularly in Europe) have standardized on the *CCITT No. 2* code arrangement which is similar to the U.S. standard, but has minor symbol and code arrangement differences.

Since each of the five data pulses can be in either a mark or space condition (two possible states per pulse), a total of $2x2x2x2x2 = 2^5 = 32$ different code combinations are possible. Since it is necessary to provide transmission of all 26 letters, 10 numerals, plus punctuation, the 32 code combinations are not sufficient. This problem is solved by using the codes twice; once in the *Letters (LTRS)* case and again in the *Figures (FIGS)* case. Two special characters, LTRS and FIGS, are used to indicate to the printer whether the following characters will be of the letters or figures case. The printer has a latching mechanism that "remembers" or stores the last received LTRS or FIGS character so that it remains in the last received case until changed. Control operations such as LTRS, FIGS, Carriage Return (CR), Line Feed (LF), Space Bar (SP), and Blank (BLNK = no print or carriage movement) are assigned to both the LTRS and FIGS case so that they can be sent in either case. The remaining 26 code combinations have different letter or numeral/symbol meanings depending upon whether preceded by a LTRS or FIGS character.

Keyboards on Baudot machines such as the Teletype Corporation Models 15 and 28 differ from standard typewriter keyboards, having only three rows of keys with the related letter and number/symbol on each keytop (Q and 1, K and (, etc). The typist soon discovers this difference! Newer electronic terminals such as the HAL DS2000 and DS3100 have standard keyboard arrangements and automatically insert LTRS or FIGS characters as they are needed. The Baudot code itself is restricted to upper case letters only since insufficient codes are available to represent lower case letters.

The Baudot code has seen extensive commercial use throughout the world and is still actively utilized for international wire communications, press, and weather. Due to the ready availability of Baudot mechanical equipment, this code will continue to be quite popular amoung radio amateurs. However, the lack of code space for control, extended punctuation, or lower case letters is a severe limitation of the 5-unit Baudot code. These limitations are particularly inconvenient in computer terminal applications. Various serial and parallel data coding schemes have been used with computers, but the ASCII data code is by far the most common. Figure 1 shows a time diagram of typical Baudot characters and the Baudot data code is shown for both the U.S. and CCITT #2 in Table 1. Notice that the waveform drawing of Figure 1 shows the *current* waveform with mark represented by the upper deflection: If the same data were observed on a RS232 data line, mark would be represented by a downward or *negative* deflection. Also, the bits in Figure 1 are arranged in a left-to-right order as would be observed on an oscilloscope. The bits in Table 1, however, are arranged in *descending* order (b_5 to b_1), conforming to the standard binary representation. Thus, the letter "D" shown in Figure 1 would be written as the binary character "01001".

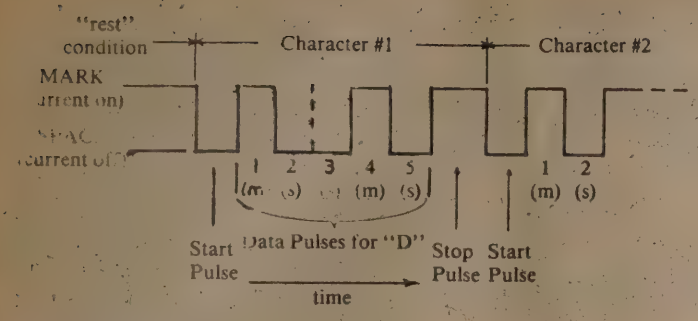

Figure 1. Time Sequence of Typical Baudot Character

Table 1, The Baudot Data Code

Bit Number 54321	Letters	U.S. Figures	CCITT#2 Figures
00000	BLANK	BLANK	BLANK
00001	E	3	3
00010	LF	LF	LF
00011	A	-	-
00100	SPACE	SPACE	SPACE
00101	S	BELL	'
00110	I	8	8
00111	U	7	7
01000	CR	CR	CR
01001	D	$	WRU
01010	R	4	4
01011	J	'	BELL
01100	N	,	,
01101	F	!	!
01110	C	:	:
01111	K	(	(
10000	T	5	5
10001	Z	"	+
10010	L	)	)
10011	W	2	2
10100	H	#	£
10101	Y	6	6
10110	P	0	0
10111	Q	1	1
11000	O	9	9
11001	B	?	?
11010	G	&	&
11011	FIGS	FIGS	FIGS
11100	M	.	.
11101	X	/	/
11110	V	;	=
11111	LTRS	LTRS	LTRS

Note: FIGS-H (10100) may also be used for MOTOR STOP function.

"1" = Mark = Hole in punched tape

The ASCII Code

In 1968, the American National Standards, Inc. (ANSI) adopted the *American National Standard Code for Information Interchange* (ASCII - commonly pronounced "as - key"), ANSI Standard X3.4-1968. This code uses seven data pulses to specify the letter, number, symbol, or *control operation* desired. An eighth data pulse is provided for optional error checking, called the *parity* bit. As with the Baudot code, the standard ASCII code approved for U.S. amateur use is asynchronous and serial with both start and stop pulses.

Whereas the five-unit "Baudot" code was arranged by Murray so that the most frequently used letters are represented by the least number of mark holes punched in paper tape, the ASCII code has been arranged to optimize computer applications. The code has been particularly designed for rapid collation of alphanumeric lists, one data bit difference between upper and lower case letters, and isolation of all control operations from printing operations. A time diagram of a typical ASCII character is shown in Figure 2. Table 2 shows the ASCII Data Code. As noted for the Baudot waveform drawing, Figure 2 shows the loop current with mark represented by the upward deflection; an oscilloscope trace of a RS232 data circuit would be inverted with mark as the more negative deflection. Also, the bits in Table 2 are arranged in binary number order (b7 - b1). Thus, the letter "S" in Figure 2 would be written as the binary number "0101 0011", with the eighth, parity bit, set to space (0).

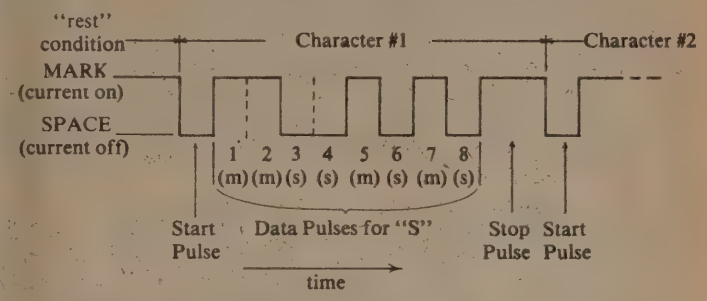

Figure 2. Time Sequence of Typical ASCII Character

Table 2, The ASCII Data Code

	7	0	0	0	0	1	1	1	1
	6	0	0	1	1	0	0	1	1
	5	0	1	0	1	0	1	0	1
4321									
0000		NUL	DLE	SPC	Ø	@	P	`	p
0001		SOH	DC1	!	1	A	Q	a	q
0010		STX	DC2	"	2	B	R	b	r
0011		ETX	DC3	#	3	C	S	c	s
0100		EOT	DC4	$	4	D	T	d	t
0101		ENQ	NAK	%	5	E	U	e	u
0110		ACK	SYN	&	6	F	V	f	v
0111		BEL	ETB	'	7	G	W	g	w
1000		BS	CAN	(	8	H	X	h	x
1001		HT	EM	)	9	I	Y	i	y
1010		LF	SUB	*	:	J	Z	j	z
1011		VT	ESC	+	;	K	[	k	{
1100		FF	FS	,	<	L	\	l	|
1101		CR	GS	-	=	M	]	m	}
1110		SO	RS	.	>	N	^	n	~
1111		SI	US	/	?	O	_	o	DEL

ACK = acknowledge
BEL = signal bell
BS = backspace (←)
CAN = cancel
CR = carriage return
DC1 = device control 1
DC2 = device control 2
DC3 = device control 3
DC4 = device control 4
DEL = (delete)
DLE = data link escape
ENQ = enquiry (WRU)
EM = end of medium
EOT = end of trans.
ESC = escape
ETB = end of block
ETX = end of text
FF = form feed (home)
FS = file separator
GS = group separator
HT = horizontal tab (→)
LF = line feed (↓)
NAK = not acknowledge
NUL = null
RS = record separator
SI = shift in
SO = shift out
SOH = start of heading
SPC = space
STX = start of text
SUB = substitute
SYN = synchronous idle
US = unit separator
VT = vertical tab (↑)

Note: "1" = Mark = Hole in punched tape

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- MSG2100 2000 Character "Brag Tape" ROM

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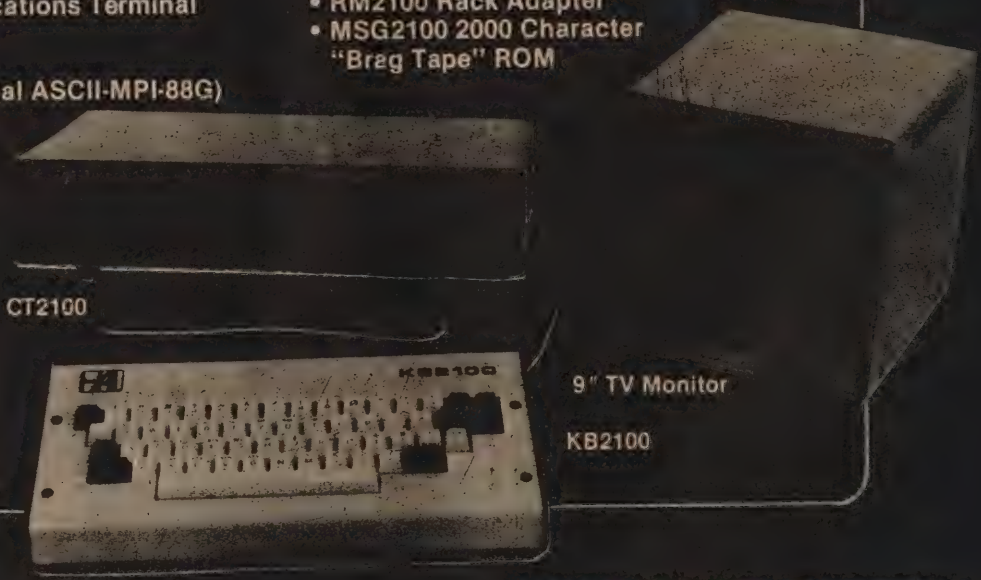
- 2 Pages of 72 Character Lines
  -or-
  4 Pages of 36 Character Lines
- Split Screen (with KB2100)



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CONTESTS

1981 RTTY Art Contest

The Southern Counties Amateur Teleprinter Society's "1981 Worldwide RTTY Art Contest" will last from 1 September through 30 November 1981. All worldwide licensed radio amateurs and members of their immediate families (except as otherwise provided in these rules) are eligible to participate in this contest.

1) Entries must have been originated by means of manual inputs to a teleprinter using standard communications keyboard, and may be submitted only by the originator of the art, or by the amateur on behalf of a family member.

2) Submitted art may be of any subject suitable for transmission via Amateur Radio.

3) Entrants may submit as many entries as desired.

4) Each entry shall be given a short title.

5) Submitted art may contain overline shading.

6) Tapes of entries shall be formatted to permit a reasonably short running time, and to be compatible with machines which do and do not downshift on space. Compatibility with machines which interchange the bell and apostrophe is not required. At least three functions must be used between each line, normally: carret LF LTRS.

7) Each line of the art shall be limited to a *maximum of 68 characters (including spaces).* Prints must be in one single part, no splices. Tapes must be limited to a maximum running time of 40 minutes at 60 words per minute for the art itself, exclusive of any other information on the tape, and contain no splices.

8) Each entry must have been transmitted for the first time via Amateur Radio after 1 September 1981 and must be accompanied by a confirmation of at least one receipt of its transmission, identifying the title of the art and the call letters of the receiving and transmitting stations. All confirmations must be in writing (not by RTTY transmission), and must have been obtained by the entrant from the receiving station. Entrants may obtain necessary transmission of their entry by an Amateur Radio station.

9) The tape and prints of each entry shall carry the full name of the author, call letters of the submitting station, and mailing address. This information shall be written upon a beginning leader of the tape and also punched in the tape to appear on page copy when reproduced.

10) Entrants must submit one five-level paper tape and five prints of each entry and by such submission agree that the tapes and prints may be used, duplicated and published for any purpose. Tape submissions shall be of the 11/16th width only.

11) Tape, prints and transmission confirmation information should be securely packaged and sent to: RTTY Art Contest, c/o Norm Koch, K6ZDL; P.O. Box 1351; Torrance, CA 90505, USA. Entries must be postmarked on or before 30 November 1981. Entries will not be acknowledged nor returned. Winners will be announced as soon as possible after the closing date. (Since mail-damaged tape will be of little value, it is suggested tapes be wound tightly upon a hard core.)

12) Entries will be judged on the originality of the author in selection of subject matter, on excellence of technique in producing the art and formatting the tape, on overall appearance of the art when viewed from a distance, on suitability for publication, and on the entrant's compliance with these rules.

13) If an individual is the first place winner in a given year, they will not be eligible for nor considered for first place in the immediate following year. They will be eligible for first place every other year. This does not preclude a station from entering and being considered for second, third or honorable mention places.

14) A committee of judges, made up from those amateurs who have exhibited an interest in RTTY art, will select first, second, third and honorable mention winners. Winning entrants will receive a plaque for their particular places. Winning entries will be published in various Amateur Radio journals. The decisions of the judges shall be final, and no correspondence will be entered into regarding their decisions.

15) Officials and judges of this contest and members of their families shall not be eligible to participate herein. □

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THE RX-2300 MICROWAVE DOWNCONVERTER

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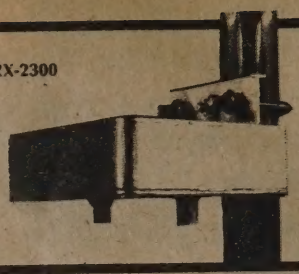

GENERAL SPECIFICATIONS:

Frequency Range: 1900 - 2700 Mhz input; 30 - 225 Mhz IF output; preset to convert the amateur band to TV channel 2, 3 or 4 (specify LOW) or channel 7, 8 or 9 (specify HIGH). The remote tuning range is plus/minus 15 Mhz

Performance: Front end device is rated **2.4 dB NF** at 2 Ghz; conversion gain is greater than 25 dB.

Power Requirements: + 12 to 17 VDC @ 30 ma. variable voltage; fed via the 75 ohm coaxial feedline.

Mechanical: Housed in a 3.6" × 4.5" × 1.1" cast metal enclosure; RF input connector is a BNC (Type N optional); output connector is a standard 75 ohm TV type F.

Antenna Requirements: Any good 2 Ghz 50 ohm horn, yagi, slotted array or parabolic dish type.

Price: $150.00 each, shipping included. Add $5.00 for Type N connector option.

Please write us detailing your requirements for other frequency options and dealer quantity pricing.

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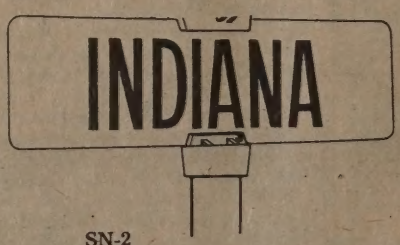

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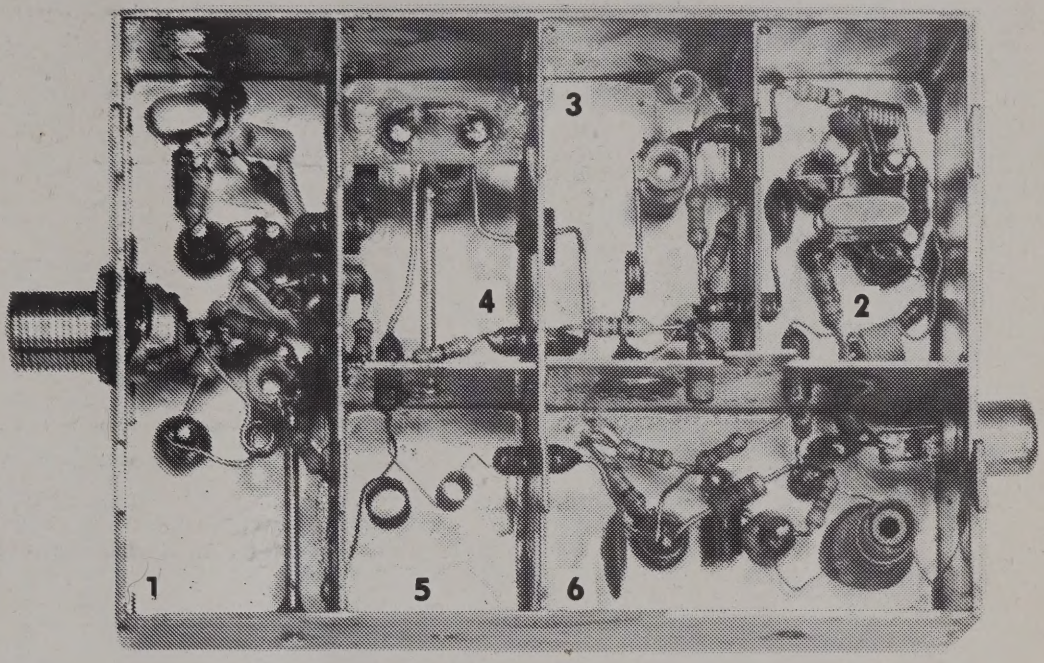

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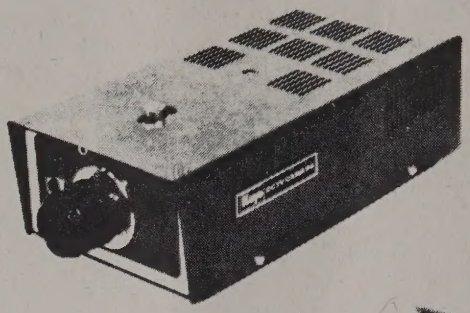

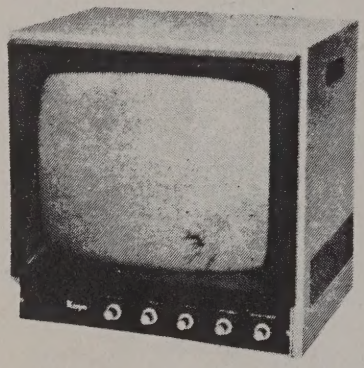

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